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IMPERIAL MINERAL RESOURCES
BUREAU.

THE MINERAL INDUSTRY OF THE BRITISH EMPIRE AND FOREIGN COUNTRIES.

WAR PERIOD.

COAL, COKE, and BY-PRODUCTS

(1913-1919)

PART II.

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INTRODUCTORY NOTE.

The general preface to the part of the Annual Mineral Conspectus of the Bureau which relates to Coal appeared in Part I. The present work is Part II and comprises general and statistical information as to Coal, Coke and By-products in respect of the British Empire other than the United Kingdom.

The Advisory Technical Committee, under the Chairmanship of Mr. W. Forster Brown (a Governor of the Imperial Mineral Resources Bureau), who revised this work, consider it desirable that it should contain a note as to the methods of ascertaining the values of imports and exports. These, as stated by the various authorities concerned, are as follows :—

(1) NORTHERN AND SOUTHERN RHODESIA AND UNION OF SOUTH AFRICA :

Imports.—The declared value of merchandise is its selling value in the principal markets of the country of purchase, including the cost of packing and packages, and the cost of its conveyance to the port of shipment.

Exports.—The export value is the value at the port of shipment, plus the cost of packing and packages; except that, in the case of exports from bonded warehouse, the value is that at which the goods were originally warehoused.

(2) CANADA :

Imports.—The value given for goods imported is the fair market value thereof when sold for home consumption in the principal markets of the country whence and at the time when the same were exported directly to Canada.

Exports.—The value of " Canadian Produce " is its value at the time of exportation at the ports of Canada whence shipped.

The value of " Foreign Produce " is the actual cost of such goods.

(3) INDIA :

The statements of both quantities and values are based on the declarations of importers in Bills of Entry and of exporters in Shipping Bills as subsequently checked by the Customs officials.

According to the provisions of the Indian Sea Customs Act, the values of goods imported or exported are based on wholesale market prices, and represent—

(*a*) the wholesale cash price, less trade discount, for which goods of the like kind and quality are sold, or are capable of being sold, at the time and place of importation or exportation, as the case may be, without any abatement or deduction whatever, except (in the case of goods imported) of the amount of the duties payable on the importation thereof; or

(*b*) where such price is not ascertainable, the cost at which goods of the like kind and quality could be delivered at such place without any abatement or deduction, except as aforesaid.

(4) AUSTRALIA :

Imports.—The value of goods imported from countries beyond the Commmonwealth represents the amount on which duty is payable or would be payable if the duty were *ad valorem.* The value of goods subject to duty is taken to be the fair market value in the principal markets of the country whence the same were exported, with an addition of 10 per cent. to such market value.

Exports.—The value of goods exported is, generally, the value in the principal markets of the Commonwealth in the ordinary commercial acceptation of the term. Some modification of this practice has, however, been necessary in consequence of the policy of price-fixing arising from the war.

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AFRICA.

Anglo-Egyptian Sudan.*

Judging by the present knowledge of the geology of the Anglo-Egyptian Sudan, there appears little likelihood of the discovery of extensive deposits of coal in that country, the Nubian sandstone covering the northern half, and igneous and metamorphic rocks the eastern portion of the country between the Nile and the Red Sea.

Bechuanaland.†

Seams of coal have been proved near Palapye and close to the Bechuanaland Railway.

East African Protectorate (Kenya).

No important coal deposits have yet been discovered in the East African Protectorate, but some carbonaceous material of lignitic character has been found near Mwèle, south-west of Mombasa. It is probably of Pleistocene age.

Analyses of Coals.‡

—	Proximate Analysis.				Sulphur.	Phosphorus.	Calorific Value.	Evaporative Power.
	Moisture.	Fixed carbon.	Volatile matter.	Ash.				
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cals.	Lb.
Sumburu		30·01	18·76	51·25				
Mwele (S.W. of Mombasa).	10·38	59·95	26·17	3·30			5,814	10·85
	13·05	43·08	27·80	16·07	·03	·007	4,419	8·25

Egypt.§

No coal of commercial importance has, as yet, been discovered in Egypt, but very thin seams, both of lignite and coal, have been met with in various wells and borings.

---

* Coal Resources of the World, 1913, Vol. II, p. 379.

† South and East African Year Book and Guide, 1920, p. 266.

‡ Bulletin of the Imperial Institute, 1912, Vol. X, p. 453.

§ Coal Resources of the World, 1913, Vol. II, p. 375. Statements of the Trade of Egypt (Annual).

Exports of Coal from Egypt (Foreign Produce).

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
British Mediterranean Possessions	1,193	529	118	19	113	—	4
Palestine	—	—	—	—	—	—	86
Syria	—	—	—	—	—	—	197
Turkey	12,973	699	—	—	—	—	511
Other Countries* ...	76,594	76,134	58,866	10,132	8,275	3,267	10,583
Total to Foreign Countries	89,567	76,833	58,866	10,132	8,275	3,267	11,377
TOTAL ...	90,760	77,362	58,984	10,151	8,388	3,267	11,381

For bunkers, in 1913, but purpose not defined in subsequent official reports.

Imports of Coal into Egypt.

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom	1,523,877	1,274,151	884,176	771,665	447,784	470,317	485,891
British Africa ...	—	—	—	9,863	10	22,467	60,615
India	—	1,161	—	6,742	—	69	879
Total from British Possessions	1,523,877	1,275,312	884,176	788,270	447,794	492,853	547,385
Belgium	1,514	693	—	—	—	—	956
France	32	15	—	—	—	—	—
Germany ...	43,293	49,963	—	—	—	—	—
Holland	—	48	—	—	—	—	—
Spain	49	—	—	—	—	—	—
United States ...	124,915	86,774	106,713	103,659	6,768	863	7,958
China	—	—	—	11	—	—	—
Japan	69	—	—	9,839	—	—	—
Other Countries	—	—	—	—	—	—	154
Total from Foreign Countries	169,872	137,493	106,713	113,509	6,768	863	9,068
TOTAL ...	1,693,749	1,412,805	990,889	901,779	454,562	493,716	556,453

Nigeria.*

In 1903, a Survey was organized to examine the mineral resources of Southern Nigeria, and was continued until 1913. Large deposits of lignite, or brown coal, were discovered on both sides of the river Niger, near Asaba, as well as in the Obongkpa and Ubiaja districts, north-west of Asaba, and the Newi district, south-east of Onitsha, but these discoveries were completely overshadowed, in their importance as fuel reserves, by the subsequent discovery in 1909 of the Udi-Okwoga coalfield, with a total area of about 1,800 square miles. † Udi coal is described as sub-bituminous (lignitic), and is dull-black in appearance. It ignites readily, burns with a bright steady flame, with little smoke, and without caking or decrepitation. Analyses gave the following results :—

	Udi, 5 ft. seam. Per cent.	Okwoga, 3 ft. 11 in. seam. Per cent.
Moisture	5·62	11·50
Fixed carbon	48·41	39·49
Volatile matter	38·18	34·96
Ash	7·79	14·05
	100·00	100·00
Sulphur	0·76	0·73
Calorific value, cals. ...	6,969	5,494

All minerals, including coal, are the property of the Government, who proceeded to establish a colliery known as the Udi Colliery. The output of coal up to December 31st, 1915, was 7,182 tons. In 1916 the output was 17,318 tons, in 1917, 83,405 tons, in 1918, 148,214 tons, and in 1919, 137,844 tons.

A line of railway was constructed, which reached the Obwati stream north-east of Udi in May, 1916, and coal arrived at the seaport at the end of that month. This railway was made in order to avoid the cost and difficulties of the navigation of the Niger and was the result of the discovery of a suitable harbour, now known as Port Harcourt.

The mines are situated near the large native town of Enugu Ngwo. The surrounding country is densely populated.

---

* Colonial Reports (Annual).

† Colonial Reports, Miscellaneous. Cd. 2876, 4994–5, 5517, 5901 6425, 7067, 7110, 7567.

The natives offer themselves in large numbers for employment and are gradually being trained to replace Europeans. The rate of payment, in 1919, was 3*d*. to 4*d*. per tub (car) of from 5 to 6 cwt.

The high market price of coal has enabled the Government to pay for all development works out of earnings, and, in addition, to contribute a yearly sum to revenue, commencing in 1917 with £47,400.

* The pit-mouth cost, exclusive of interest on capital outlay for development and exploration, has varied from 9*s*. 2*d*. to 7*s*. 2*d*. per ton, the Iva valley output being much cheaper. Railway freight to the port and handling charges there added 19*s*. 6*d* per ton, thus making the f.o.b. cost at Port Harcourt approximately 28*s*. per ton. The coal sold at 33*s*. per ton during the war. According to Sir F. D. Lugard's report, which is dated April 9, 1919, the normal cost of freight to Lagos could not then be calculated accurately, owing to the abnormal cost of shipping. The cost of vessels chartered from the Admiralty was put at 24*s*. 6*d*. per ton, with a margin of profit. The shipping line charges were 40*s*. a ton. The cost to Government departments, *ex* wharf Lagos, in 1917 was 58*s*. 6*d*. reduced to 56*s*. in 1918. The value of the coal for steam-raising purposes was estimated at 80 per cent. of the best Welsh; this percentage could probably be considerably increased by the adaptation of the fire boxes. Before the war the price of Welsh coal landed at Lagos was about 37*s*., at which price the Udi coal cannot compete until the cost of winning has been reduced by better machinery, larger output, and cheaper ocean transport. Welsh coal was practically unprocurable, but commanded 105*s*. a ton at Lagos in 1916. At that figure the relative price of Udi coal would be 72*s*. 2*d*.

The Government was, in 1919, in a position to fix a reasonable royalty from actual knowledge, and was prepared to grant leases of other areas of coal lands to private enterprise as soon as the railway was able to provide adequate haulage, and the wharf and other arrangements at Port Harcourt were able to cope with the traffic.

The chief accountant calculated that, in 1919, the working costs of a company, including directors' fees, etc., would be 8*s*. 4*d*. per ton, and that, with a pit's mouth price of 10*s*., a dividend of 8 per cent. would accrue on the capital outlay with 1*s*. royalty, or 12 per cent. with a royalty of 6*d*. The profits would be increased by a greater output, and better machinery.

---

* Report on the Amalgamation of Northern and Southern Nigeria and Administration. By Sir F. D. Lugard. 1912–1919, p. 54.

Thin seams of good black coal occur also in the valley of the Mamu, south-west of Udi.

Analyses of Nigerian Coal.[*]

—	12 ft. seam. Source of Eze.		3 ft. 6 in. seam. Newi Ichi.	3 ft. 9 in. seam. Omaiella Stream.	Obaneno Stream (upper spring).	Obaneno Stream (lower spring).	Dark, Shaly. Obelele Stream.	Atakpo Valley, Okpanam.	
	Smaller Sample.	Larger Sample.						Consignment of 10 tons.	The same dried to 10 per cent. of moisture.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Volatile matter ...	48·17	39·31	47·00	45·64	47·25	41·15	42·32	42·36	52·53
Fixed carbon	29·83	25·16	23·60	32·87	31·26	35·60	32·29	25·84	32·04
Water	10·88	20·67	7·09	13·41	12·46	14·11	12·23	27·42	10·00
Ash	11·12	14·86	22·31	8·08	9·03	9·14	13·16	4·38	5·43
Sulphur	1·08	0·67	0·79	1·97	0·65	0·86	0·78	—	—
Calorific value (calories)	5,669	4,681	5,043	5,530	5,502	5,112	4,973	5,018	6,189
Evaporative power lb.	10·58	8·74	9·41	10·32	10·27	9·54	9·28	9·37	11·55

[*] Coal Resources of the World, 1913, Vol. II., p. 386.

Nyasaland Protectorate.

The coal of Nyasaland is found in the Karroo system. Two seams of bituminous coal, two feet and five feet in thickness respectively, occur at Mount Waller, near Lake Nyasa. Coal occurs also at Nkana, Lufira, Kasante and in the vicinity of the Northern Rukuru River, but it is not of such good quality as that at Mount Waller. The coal in the Mount Waller area is bituminous, cakes well and is suitable for the manufacture of metallurgical coke.

In the Lower Shire district, on the south-west border, the Karroo system underlies an area of about 800 square miles, and is known to contain a few thin seams of non-caking, bituminous coal.

*Analyses of Nyasaland Coals.**

Areas.		Volatile Matter.	Fixed Carbon.	Moisture.	Ash.	Sulphur.	Calorific Value.	Evaporative Power.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cals.	Lb.
Mandengo ...	Average of 4	27·75	43·89	6·61	21·74	—	5,303	9·90
	Best ...	27·83	44·06	5·55	22·56	1·24	5,533	10·33
Kanjoka ...	Average of 10	27·05	35·91	8·95	28·09		4,135	7·72
	Best ...	29·82	44·97	9·36	15·85	0·86	5,171	9·65
Kasante, Lufira and Mpata	Average of 7	23·73	47·91	8·89	19·47		4,080	7·62
	Best ...	23·31	55·51	8·90	12·28	1·24	5,369	10·02
Mwenemguwe and Vungwu Rivers	Best ...	27·73	47·63	6·00	18·64	0·49	5,533	10·33
	Worst ...	20·87	29·15	5·60	44·38	0·66	3,527	6·58
Mwapo and Sere River	Average of 9	20·38	39·86	3·46	36·30	—	4,440	8·29
	Best ...	29·99	53·78	4·55	11·68	0·82	6,424	11·99
West Nyika :—								
South of Chimanga Village		23·40	32·20	4·61	39·79	0·55	4,836	9·03
North of Chimanga Village		28·02	57·36	2·03	12·59	1·05	6,591	12·30
Quewera Stream, near Chimanga Village		28·80	48·03	0·50	22·67	0·54	6,090	11·37
Southern Nyika	Western...	26·25	44·59	2·05	27·11	0·72	5,644	10·53
	Eastern	28·10	36·05	11·11	24·74	0·58	4,039	7·54
		17·63	36·28	4·12	41·97	0·82	3,694	6·89
Mount Waller :—								
Zindira Stream		23·80	56·92	1·30	17·98	0·59	6,814	12·72
Rumpi River	Highest Seam ...	28·11	59·76	1·25	10·88	0·64	7,872	14·69
	Lowest Seam ...	24·11	66·73	1·01	8·15	0·62	7,982	14·90
Lower Shire :—								
Nachipere		12·24	70·15	2·58	15·03			
Sumbu	Top Seam ...	9·92	47·17	1·38	41·53			
	Lowest Seam ...	31·70	20·41	1·06	46·83			

* Coal Resources of the World, 1913, Vol. II., pp. 401–409.

Northern Rhodesia.*

The coal-bearing beds of Northern Rhodesia belong to the Karroo formation. As far as is at present known, the principal coal-bearing areas are situated in the Luano district, close to the Portuguese East African border, and about 70 miles north of the Zambesi river.

The area of the Luano coalfield is estimated at 500 square miles, and outcrops of coal occur in many parts of it.

The whole of the requirements of Northern Rhodesia are supplied by the Wankie coalfield, in Southern Rhodesia.

---

* Statements of the Trade and Shipping of the Union of South Africa, and of Southern and Northern Rhodesia (Annual).

Imports of Coal and Coke into Northern Rhodesia.

Year.	Quantity (long tons).	Value. (£)
1913	6,672	3,446
1914	12,154	5,802
1915	8,089	4,625
1916	10,292	6,232
1917	24,456	17,588
1918	31,083	28,178
1919	36,056	29,130

Southern Rhodesia.*

The production of coal in Southern Rhodesia increased from 217,257 tons in 1913 to 438,632 tons in 1918, and is all obtained from the Wankie coalfield. This area yields an excellent steam-raising coal, with good coking qualities. The lower and better grade seam has an average thickness of about 6 ft., while the upper seam varies from 5 ft. to 29 ft. in thickness. It was announced, in 1919, that a seam, 28 to 30 ft. thick, was being opened up in a new area. Coal deposits are known to exist in many parts of the country, the thickness of the seams being very variable; little development, however, has taken place. The output in 1919 was 455,393 tons.

The composition of samples of the Wankie coal,† picked at random, was as follows:—

—	Fixed Carbon.	Volatile Matter.	Ash.	Sulphur.	Moisture.	Total.	Evaporative Power.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Lb.
East Slant...	65·13	22·67	9·96	1·54	0·70	100·00	13·26
Main Dip ...	64·55	20·71	11·29	2·62	0·83	100·00	12·96
West Slant...	62·72	19·41	12·96	4·18	0·73	100·00	12·67

COKE AND BY-PRODUCTS.

In Southern Rhodesia, the production of coke from the Wankie Collieries has increased from 20,462 tons in 1914 to 92,622 tons in 1919.

It is all made in beehive ovens.

---

* Reports of the Rhodesia Chamber of Mines (Annual). Reports of the Secretary for Mines, Southern Rhodesia (Annual). Statements of the Trade and Shipping of the Union of South Africa, and of Southern and Northern Rhodesia (Annual).

† Southern Rhodesia, Geol. Survey Bull. No. 4, p. 39, 1914.

Coal Resources of Rhodesia.[*]

District.	Including seams of 1 ft. or over, to a depth of 4,000 ft.						
	Coal seams.		Actual reserve. (Calculation based on actual thickness and extent.)		Probable reserves. (Approximate estimate.)		Possible reserve.
	No.	Thickness.	Area.	Tons.	Area.	Tons.	
Tuli :—							
Umsingwani	1	3 ft.	1,000 acres ...	5,018,000			Relatively large.
Singmesi	1	3 ft. 6 in. ...	300 acres ...	1,756,000			
Massabi	1	4 ft.	5,400 acres ...	36,159,000	7 sq. miles	29,974,000	
Sabi	1	2 ft. 6 in. ...	1,750 acres ...	7,682,000	—	—	Relatively large.
Wankie	1	6 ft. to 12 ft. 6 in.	20 sq. miles	197,966,000			
Sebungu Mafungabusi :—							
Lubu	2	3 ft. and 2 ft. ...	—	—	15 sq. miles	80,239,000	
Sengwe...	1	5 ft.	8,200 acres ...	68,580,000			
Mafungabusi	2	10 ft. 9 in. agg. ...	3,500 acres ...	73,391,000			
Lufua and Losito	2	4 ft. and 3 ft. ...	—	—	5 sq. miles	37,468,000	Large.
Luano	4	18 ft. 10 in. agg.	700 acres ...	22,055,000	—	—	Large.
TOTAL	16	68 ft. 10 in. ...	52 sq. miles, 370 acres.	412,607,000	27 sq. miles	147,681,000	

	Tons.
Actual reserve	412,607,000
Probable reserve	147,681,000
Total	560,288,000

---

[*] Coal Resources of the World, 1913, Vol. II., p. 396.

Production, Sales and Values of Coal in Southern Rhodesia.

Year.	Quantity raised (long tons).	Quantity sold (long tons).	Value of sales (£).
1913	217,257	155,052	78,421
1914	312,017	237,120	115,099
1915	365,860	257,194	123,194
1916	438,912	275,652	131,468
1917	490,137	288,416	179,588*
1918	438,632	254,743	164,850*
1919	455,393	260,446	189,137*

* Including value of coal used for coke and brick manufacture.

Exports of Coal from Southern Rhodesia (Domestic Produce).

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Northern Rhodesia	7,479	12,156	7,688	9,385	20,111	21,108	26,861
Union of South Africa	15,498	15,163	11,082	11,528	11,550	8,938	8,546
Total to British Possessions	22,977	27,319	18,770	20,913	31,661	30,046	35,407
Belgian Congo ...	2,982	40,642	37,483	48,606	43,276	35,245	27,617
Portuguese East Africa	—	2,107	2,726	7,583	16,415	18,010	19,274
Total to Foreign Countries	2,982	42,749	40,209	56,189	59,691	53,255	46,891
TOTAL ...	25,959	70,068	58,979	77,102	91,352	83,301	82,298
	Value (£).						
Northern Rhodesia	3,446	5,802	3,896	4,584	9,811	11,265	13,681
Union of South Africa	6,913	7,505	5,273	5,487	5,497	4,254	4,250
Total to British Possessions	10,359	13,307	9,169	10,071	15,308	15,519	17,931
Belgian Congo ...	1,210	17,518	15,745	21,720	18,021	14,962	11,604
Portuguese East Africa	—	1,003	1,309	3,612	8,189	8,595	8,647
Total to Foreign Countries	1,210	18,521	17,054	25,332	26,210	23,557	20,251
TOTAL ...	11,569	31,828	26,223	35,403	41,518	39,076	38,182

*Coal used in the manufacture of Coke in Southern Rhodesia, the quantity of Coke obtained, and the yield of Coke per ton of Coal; also the quantity of Coal used in Brick-kilns.**

Year.	Coal used for Coke (long tons).	Coke produced (long tons).	Yield of Coke per ton of Coal.	Coal used at Brick-kilns (long tons).
1913 ...	†	20,462	†	†
1914 ...	31,060	18,636	·60	3,159
1915 ...	44,935	26,953	·60	4,443
1916 ...	88,534	53,120	·60	1,203
1917 ...	111,080	70,090	·64	1,954
1918 ...	106,876	77,039	·72	606
1919 ...	135,152	92,622	·69	3,228

* The Wankie Colliery Company is the only producer of coke in Southern Rhodesia.

† Not stated.

Exports of Coke and Patent Fuel from Southern Rhodesia.

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Northern Rhodesia	—	—	401	906	4,346	9,975	9,196
Union of South Africa	—	2	3	35	314	33	23
Total to British Possessions	—	2	404	941	4,660	10,008	9,219
Belgian Congo ...	19,452	13,293	17,368	40,239	50,934	55,009	77,781
Portuguese East Africa	—	—	2	15	19	46	21
Total to Foreign Countries	19,452	13,293	17,370	40,254	50,953	55,055	77,802
Total ...	19,452	13,295	17,774	41,195	55,613	65,063	87,021
	Value (£).						
Northern Rhodesia	—	—	729	1,648	7,777	16,913	15,449
Union of South Africa	—	4	9	63	619	65	94
Total to British Possessions	—	4	738	1,711	8,396	16,978	15,543
Belgian Congo ...	35,401	23,368	24,315	56,335	71,309	73,895	114,997
Portuguese East Africa	—	—	19	19	43	86	42
Total to Foreign Countries	35,401	23,368	24,334	56,354	71,352	73,981	115,039
Total ...	35,401	23,372	25,072	58,065	79,748	90,959	130,582

Imports of Coke and Patent Fuel into Southern Rhodesia.

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	242	253	144	521	202	153	190
Union of South Africa	—	—	—	—	50	66	22
Germany	28	12	—	—	—	—	—
TOTAL ...	270	265	144	521	252	219	212
	Value (£).						
United Kingdom ...	472	429	263	592	486	362	573
Union of South Africa	—	—	—	1	72	294	100
Germany	58	24	—	—	—	—	—
TOTAL ...	530	453	263	593	558	656	673

Swaziland.*

A considerable amount of work has been done in prospecting deposits of anthracite coal in the low country, 20 miles from the Portuguese border, and 70 miles from Delagoa Bay. When the country is opened up by the railway connecting the fields with the Delagoa Bay line at Gabo, these deposits should prove of some importance, as the quality is said to be excellent.

Union of South Africa.†

Deposits of coal are found in all four Provinces of the Union of South Africa, but the production in Cape Province is inconsiderable.

These coals occur in strata of the Karroo System, which corresponds with strata ranging in age from the Permian, and, perhaps, the late Carboniferous, to the Jurassic. It is estimated that the Union contains 97 per cent. of the known African deposits, and Rhodesia 1 per cent.‡ South African coal is, with the exception of East Indian coal, the cheapest in the world. These coalfields are playing an essential part in the economic development of South Africa, the distance from any of the important coalfields of the world and the low price of the South African coal attracting numerous steamers, for bunkers and for export coal, to the ports of Durban and Delagoa Bay.

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* South and East African Year Book and Guide, 1920, p. 266.

† Reports of the Government Mining Engineer (Annual). Statements of the Trade and Shipping of the Union of South Africa and of Southern and Northern Rhodesia (Annual).

‡ Coal Resources of the World, 1913, Vol. I., p. xxiii.

It is a noteworthy feature of the South African coalfields that the seams are found at very shallow depths, and that those seams which are abnormally thick contain a greater proportion of impure coal, and are less constant in character and continuity than seams of medium thickness.

Igneous intrusions have materially altered the quality of the coal in some districts—especially in northern Natal, where dykes passing through the Coal Measures have destroyed the value of the coal for short distances from the planes of contact, roughly equivalent to the thickness of the dykes. Intrusive sheets in contact with a seam usually destroy its value, and, when separated from the coal by sandstone and shale, which form the main body of the Coal Measures, their effect is roughly proportional to the thickness of the sheet, and varies inversely with the distance of the sheet from the coal. The high calorific value of some of the Natal coal seams is attributed to this cause. It seems probable that, in some cases, hot mineral solutions have penetrated the laminations of the coal seams and have deposited their contents, thus increasing the relative percentage of the ash in the coal, and, sometimes, driving off an appreciable quantity of volatile hydrocarbons.

The third Interim Report of the Royal Commission on the Natural Resources, Trade and Legislation of certain portions of His Majesty's Dominions (July, 1914), contains the following summary :—

> "The coal industry has shown remarkable growth in recent years, and the nearness of the coalfields to the Witwatersrand is of immense importance in contributing to low working costs on the gold mines. The cheapness of supplies is also of importance to the railway, and the growing amount of South African coal used for export and bunkering purposes should exercise a considerable influence upon Imperial ocean communication. The possession of abundant and easily worked coal, also, may be of great value in future years in the development of subsidiary industries in the Union, particularly as an aid to working the undoubtedly large iron-ore deposits which exist at several points, all, somewhat unfortunately, in districts far from the coast."

The chief consumers of coal, at present, are the mines, the Government railways, and the ships that coal at Union ports. The Union is as yet in an early stage of development, and with the increase of railway communication and the opening up of the numerous industries, for which South Africa has the means and facilities, a large demand for coal must follow.

South African coal is now used, exclusively, by the Union Railways, as well as by the Rhodesian and Portuguese Colonial

Railways, the tonnage of coal consumed by the Union Railways in 1916 being 2,045,353 tons.

A test of the quality of the various coals, which did not include coal from the principal Transvaal fields, was made on the Cape Government Railways in 1891. The average consumption per train-mile was:—Welsh coal, 30 lb.; Dundee (Natal), 38 lb.; Vereeniging, 44 lb.; Indwe, 48 lb.; Cyphergat, 58 lb.; Fairview, 58 lb.; Molteno, 64 lb.

The report of the Select Committee of 1893, on the values of different Colonial coals, stated that to produce the same quantity of heat as can be obtained from 100 lb. of best Welsh coal the following quantities are required: Indwe coal, 161 lb.; Vereeniging, 169 lb.; Cyphergat and Fairview, 179 lb.; Molteno, 204 lb. Many Colonial coals require special grates and careful stoking in order to prevent clinkering. Dundee (Natal) coal was not included in the above report, but it works out at about 128 lb.

The coal export and bunker trade increased during the war, and there has been of late years a considerable market in South America, Sudan, India, Ceylon, and the Far East; and such countries as Argentina, Mauritius and Madagascar are likely to require steadily increasing quantities.

South Africa should, for many years, be able to supply coal at a cheap rate, and while wages are likely to increase in the older countries, the native of South Africa will probably remain content to work for far less than the European miner. This fact, combined with their favourable geographical situation, enables the South African coalfields to compete, on advantageous terms, with those of other countries of the world.

In December, 1919, there were 33 coal-mining concerns at work in the Transvaal, 4 in the Cape Province, 4 in the Orange Free State, and 27 in Natal.

During the war, Durban came prominently to the front as a coaling port, largely in consequence of the restriction on the Suez Canal route to Europe. But additional railway facilities are essential if the Vryheid (Natal) and south-eastern Transvaal coal districts are to be developed to their full capacity, and if Durban is to be an effective outlet for their production. That port has a unique position for bunkering and for export to all countries in the southern hemisphere.

In 1917, the price of bunker coal at Durban was from 24*s*. 4*d*. to 28*s*. 3*d*., at Capetown from 31*s*. 11*d*. to 36*s*. 6*d*., and at Delagoa Bay from 25*s*. 9*d*. to 31*s*. 4*d*. per ton. These figures included the war surcharge of 6*s*. 9*d*. per ton imposed by the South African Railways and Harbours Department, in respect of bunker coal, in June, 1916. In December, 1917, a further surcharge of 4*s*. 6*d*. per ton was made, and in May, 1918, a terminal charge of 6¾*d*. per ton was added, bringing the total increases to, approximately, 11*s*. 10*d*. per ton.

* Prior to the war, the railway rate from Witbank to Lourenço Marques (Delagoa Bay) was 6*s*. 9*d*. per ton, which, with the increase of 11*s*. 10*d*. stated above, made the total rate 18*s*. 7*d*. per ton. In January and November, 1919, surcharges amounting to 25 per cent. on the increased rates were imposed, making the total rate 23*s*. 3*d*. per ton. In May, 1920, the surcharges were replaced by a consolidated charge of 22*s*. 6*d*., making the total rate 29*s*. 3*d*. In June, 1920, the rate was raised to 40*s*. 5*d*. In February and March, 1921, reductions of 7*s*. 6*d*. and 2*s*. 6½*d*. per ton, respectively, were made, thereby lowering the rate to, approximately, 30*s*. 5*d*. per ton, which is 4½ times the pre-war rate.

In 1917, the total sales of coal for the Union were 9,270,464 tons, and in 1918, 8,819,040 tons, of which the sales from the Transvaal mines amounted to 5,929,669 tons, and 5,749,072 tons respectively. The Transvaal coal output far exceeds that of other provinces in South Africa, owing to the large markets provided by the gold mines and the mining towns. In bunkering and export trade, however, the Transvaal is less developed than Natal. All Transvaal coal for shipment goes to Delagoa Bay and Capetown. The sales of bunkering coal, mostly Transvaal, at Capetown during 1918 amounted to 294,075 tons. Some Natal coal is sent overland to Capetown. At Delagoa Bay, in 1918, the Transvaal coal mines shipped 242,000 tons for bunkering purposes, and exported as cargo to various ports 456,566 tons. In 1917, the sales of bunker and cargo coal at Delagoa Bay amounted to 396,369 tons and 377,979 tons respectively. Thus over a million tons of the total sales of Transvaal coal, given above, are for what may be termed external demands, which leaves a quantity of about 5 million tons for the yearly needs of the mines, power plants, and industries of the province.

The productive capacity of the Transvaal coalfield, from Witbank southwards, is increasing considerably, and, by 1921, will amount approximately to 10 million tons per annum. The output and selling price are, at present, regulated by an Association. As the coal lies at shallow depths, and as the development of the field is easy and comparatively cheap, there is a tendency towards over-production.

PATENT FUEL.

Some briquettes were manufactured by the Natal Navigation Collieries. A factory was started in Durban and equipped to turn out 200 tons a day of 10 hours. The briquettes were of the "eggette" type (5 ozs.). The factory ran for four months, producing from 20 to 30 tons of briquettes daily, which were sold for bunkering purposes, but it was closed down at the end of April 1915 owing to the unfavourable conditions then prevailing in the coal trade.

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* South African Engineering and Mining Journal (Special Coal Number), July, 1921, p. 47.

Coal Resources of the Union of South Africa.

	Area.	Thickness of coal (average).	Probable reserve.	Percentage proportion of the various classes.				
				Anthracite and Anthracitic.		Bituminous.		
				Yields 3 to 5 per cent. of volatile matter.	Yields 7 to 12 per cent. of volatile matter, and does not coke.	Yields 12 to 15 per cent. of volatile matter, and does not readily coke.	Yields 12 to 26 per cent. of volatile matter, and generally cokes.	Yields 30 to 40 per cent. of volatile matter, leaving very porous coke.
	Sq. miles.	Feet.	Millions of tons.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Transvaal ...	5,000	6	36,000	—	—	—	80	20
Natal ...	1,000	7	9,400	25	25	25	25	—
Zululand ...	1,250	4	6,000	50	50	—	—	—
Orange Free State	Impossible to make even a rough estimate, but the total resources will probably be not less than :—			—	—	—	80	20
Cape of Good Hope				10	10	30	30	20
Basutoland...								
Swaziland ...	1,000	4	4,800					
Total ...	...	...	56,200					

* The Coal Resources of the World, 1913, Vol. II., p. 416.

Analyses of Coals of the Union of South Africa.

No.	Locality.	Fixed Carbon.	Volatile Hydro-carbons.	Ash.	Sulphur.	Moisture.	Evaporative Power.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Lb.
	Transvaal :—						
1	"Main seam," Witbank Coalfield (average over lower 12 feet)	57·19	25·83	14·76	[0·53]	2·22	12·07
2	T. & D.B. Colliery, Witbank (average steam coal)	60·60	21·93	14·83	1·59	1·05	11·24
3	Apex Colliery, Brakpan	51·50	24·47	17·20	1·37	5·46	10·00
4	Liliput (Limpopo area)	Coal rather inferior—not more than					10·05
	Orange Free State :—						
5	Coal only of second grade quality—a useful steam and household coal						10·65
	Natal :—						
6	Hatting Spruit	67·82	19·90	10·08	1·58	1·16	13·96
7	Newcastle	56·10	28·96	11·52	1·23	2·60	14·34
8	Dannhauser	57·63	29·06	11·02	1·20	1·50	14·46
9	Utrecht	64·20	24·64	7·60	1·00	2·90	13·19
10	Wessels Nek	63·36	16·48	17·67	1·74	1·35	13·84
11	Paulpietersburg... ...	65·89	23·43	8·20	1·03	1·80	13·97

Note.—(1), (3) to (11). Official Year Book of the Union of South Africa, 1919
(2). Transvaal Mines Department, Geological Survey, Memoir No. 2. The Geology of the Komati Poort Coalfield. By H. Kynaston, 1906.

Production of Coal in the Union of South Africa.

Year.	Output.		Sales.	
	Quantity mined (long tons).	Tons of waste sorted out of coal mined.	Quantity sold (long tons).	Value at pit's mouth (£).
1913 ...	9,582,726	1,631,561	7,858,229	2,240,458
1914 ...	9,125,016	1,418,137	7,569,574	2,258,896
1915 ...	8,976,669	1,421,376	7,394,039	2,142,479
1916 ...	10,965,889	1,824,064	8,935,270	2,739,665
1917 ...	11,444,087	1,668,029	9,270,464	3,275,608
1918 ...	10,692,162	1,384,154	8,819,040	3,224,597
1919 ...	11,110,254	1,418,616	9,166,192	3,416,244

Sales of Coal in the Union of South Africa.

Year.	Transvaal.			Cape.*			Orange Free State.			Natal.			Total.	
	Quantity (long tons).	Value (£).	Value per ton.	Quantity (long tons).	Value (£).	Value per ton.	Quantity (long tons).	Value (£).	Value per ton.	Quantity (long tons).	Value (£).	Value per ton.	Quantity (long tons).	Value at pit's mouth (£).
			s. *d.*			*s.* *d.*			*s.* *d.*			*s.* *d.*		
1913	4,665,211	1,142,598	4 10·78	60,251	38,752	12 10·36	544,619	167,409	6 1·77	2,588,148	891,699	6 10·69	7,858,229	2,240,458
1914	4,604,703	1,150,746	4 11·98	47,876	31,167	13 0·24	624,301	191,064	6 1·45	2,292,694	885,919	7 8·74	7,569,574	2,258,896
1915	4,645,362	1,145,060	4 11·16	41,830	26,591	12 8·57	649,601	188,364	5 9·60	2,057,246	782,464	7 7·28	7,394,039	2,142,479
1916	5,479,387	1,382,680	5 0·56	37,279	24,092	12 11·11	680,871	198,699	5 10·04	2,737,733	1,134,194	8 3·42	8,935,270	2,739,665
1917	5,929,669	1,586,062	5 4·20	7,411	5,950	16 0·70	752,763	217,292	5 9·28	2,580,621	1,466,304	11 4·37	9,270,464	3,275,608
1918	5,749,072	1,632,361	5 8·14	4,156	3,566	17 1·96	738,015	229,736	6 2·70	2,327,797	1,358,934	11 8·11	8,819,040	3,224,597
1919	5,912,780	1,694,131	5 8·77	4,249	3,750	17 7·81	748,267	231,332	6 2·20	2,500,896	1,487,031	11 10·70	9,166,192	3,416,244

* The higher price obtained for coal in the Cape Province is due to the absence of competition, and not to any superiority of quality.

Number of Coal-cutters in use in the Union of South Africa in December. Class of power employed. Percentage of mining work accomplished by machines over the year.

Year.	Transvaal.				Cape.				Orange Free State.				Natal.				Union of South Africa.			
	Electricity.	Compressed air.	Total.	Percentage of work done to total tonnage mined by collieries using coal-cutters.	Electricity.	Compressed air.	Total.	Percentage of work done to total tonnage mined by collieries using coal-cutters.	Electricity.	Compressed air.	Total.	Percentage of work done to total tonnage mined by collieries using coal-cutters.	Electricity.	Compressed air.	Total.	Percentage of work done to total tonnage mined by collieries using coal-cutters.	Electricity.	Compressed air.	Total.	Percentage of work done to total tonnage mined by collieries using coal-cutters.
1913 ...	—	272	272	59·35	4	—	4	23·40	—	20	20	28·99	21	141	162	57·33	25	433	458	56·30
1914 ...	—	293	293	63·86	4	—	4	14·46	—	13	13	19·95	41	122	163	56·85	45	428	473	57·78
1915 ...	1	326	327	69·41	2	—	2	5·82	—	4	4	1·30	13	147	160	59·12	16	477	493	60·13
1916 ...	3	352	355	93·15	1	—	1	·60	—	15	15	23·31	16	150	166	57·67	20	517	537	75·82
1917 ...	6	382	388	81·47	—	—	—	—	—	15	15	34·93	22	162	184	56·78	28	559	587	71·21
1918 ...	6	401	407	82·05	—	—	—	—	—	19	19	39·59	23	118	141	57·49	29	538	567	72·18
1919 ...	7	379	386	81·81	—	—	—	—	1	24	25	64·71	17	120	137	48·53	25	523	548	71·57

Exports of Coal from the Union of South Africa (Domestic Produce).

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	136	44	3	2	5	20,778	5,610
Ascension Island ...	—	—	—	—	—	—	30
British East Africa	3,868	12,531	2,133	22,787	53,819	22,294	27,390
British West Africa	2,872	4,538	14,068	23,675	14,648	2,033	—
Egypt	—	—	33,722	27,019	43,115	110,549	82,783
Mauritius	2,569	13,401	31,372	62,296	44,271	48,410	39,889
St. Helena	—	—	3	6	24	77	100
Seychelles	—	884	522	—	205	200	—
South West Africa Protectorate	—	—	452	1,484	324	1,316	13
Zanzibar	5,023	5,729	8,836	4,775	29,490	39,317	15,703
Falkland Islands ...	—	—	7,061	1,224	7,984	11,938	16,707
Aden	—	31,564	30,886	105,246	64,078	226,285	314,101
Ceylon	59,887	121,342	76,171	78,258	59,113	173,182	152,642
India	216,121	158,409	103,688	15,077	14,471	49,796	38,715
Straits Settlements	30,497	25,357	10,040	2,340	11,562	22,567	39,735
Australia	—	5,718	2,154	6,621	2,322	19	35,730
New Zealand ...	—	3,409	—	1,093	2,236	—	5,440
Total to British Possessions	320,973	382,926	321,111	351,903	347,667	728,761	774,588
French Possessions	2,611	4,887	11,716	31,629	32,210	43,939	54,566
Greece	—	—	—	—	—	46,678	12,173
Italian Possessions...	—	—	—	—	—	860	5,978
Belgian Congo ...	—	—	—	—	200	—	—
German East Africa	3,120	1,108	—	—	—	—	—
German South West Africa	644	651	—	—	—	—	—
Madagascar ...	1,853	867	21,191	28,861	47,498	19,326	16,164
Portuguese East Africa	434,200	153,736	16,516	35,170	29,114	24,965	26,386
Portuguese West Africa	900	6,168	25,483	19,390	13,708	17,804	24,523
Argentina	—	—	49,412	35,701	4,219	116,779	52,779
Brazil	—	—	—	—	—	7	1,843
Chile	—	—	—	—	—	2,500	—
Ecuador	—	—	5,233	—	—	—	—
Uruguay	—	1,000	—	—	3,498	74,179	1,429
Persia	—	—	1,605	—	—	—	—
Philippines	—	6,212	—	—	2,850	3,114	—
Dutch East Indies...	—	23,713	—	2,378	—	—	4,457
Other Foreign Countries	12	170	—	—	—	4	122
Total to Foreign Countries	443,340	198,512	131,156	153,129	133,297	350,155	200,420
TOTAL ...	764,313	581,438	452,267	505,032	480,964	1,078,916	975,008

Exports of Coal from the Union of South Africa (Domestic Produce)—continued.

To	Value (£).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	86	33	3	2	6	24,687	6,940
Ascension Island ...	—	—	—	—	—	—	68
British East Africa	2,753	8,195	1,557	12,985	30,416	18,348	20,044
British West Africa	1,959	2,891	9,952	17,592	10,271	2,438	—
Egypt	—	—	16,852	17,061	38,560	116,982	82,124
Mauritius	1,722	5,244	13,769	38,388	26,669	44,735	32,977
St. Helena	—	—	4	15	74	252	325
Seychelles	—	681	392	—	250	238	—
South West Africa Protectorate	—	—	747	2,815	811	2,436	19
Zanzibar	3,443	3,445	6,163	3,479	25,917	36,592	15,094
Falkland Islands ...	—	—	5,857	976	4,933	13,135	24,816
Aden	—	8,838	8,584	67,099	40,599	206,083	276,472
Ceylon	42,148	53,051	27,874	45,515	36,788	175,494	134,778
India	135,301	69,378	37,503	9,620	9,975	44,530	39,082
Straits Settlements	20,543	13,868	7,372	2,016	6,474	26,272	47,771
Australia	—	3,974	1,734	3,708	2,077	20	42,422
New Zealand ...	—	954	—	983	2,886	—	3,656
Total to British Possessions	207,955	170,552	138,363	222,254	236,706	712,242	726,588
French Possessions	1,919	1,628	8,424	19,952	22,207	33,421	61,763
Greece	—	—	—	—	—	31,367	8,180
Italian Possessions...	—	—	—	—	—	1,022	6,208
Belgian Congo ...	—	—	—	—	220	—	—
German East Africa	2,071	757	—	—	—	—	—
German South West Africa	843	986	—	—	—	—	—
Madagascar... ...	1,250	273	10,581	17,503	29,704	16,808	16,255
Portuguese East Africa	122,233	45,291	12,170	20,897	17,056	17,043	17,887
Portuguese West Africa	1,177	1,727	9,166	11,703	7,729	18,222	26,173
Argentina	—	—	30,693	28,614	3,120	117,072	55,833
Brazil	—	—	—	—	—	33	2,304
Chile...	—	—	—	—	—	2,656	—
Ecuador	—	—	3,762	—	—	—	—
Uruguay	—	280	—	—	1,959	78,703	1,682
Persia	—	—	449	—	—	—	—
Philippines	—	1,739	—	—	2,100	4,467	—
Dutch East Indies...	—	12,727	—	1,332	—	—	5,668
Other Foreign Countries	9	48	—	—	—	8	231
Total to Foreign Countries	129,502	65,456	75,245	100,001	84,095	320,822	202,184
TOTAL ...	337,457	236,008	213,608	322,255	320,801	1,033,064	928,772

Exports of Coal, by Ports, from the Union of South Africa.

Port of shipment.	Quantity (long tons).						
	1913.†	1914.	1915.	1916.	1917.	1918.	1919.
Capetown		821	2,657	6,654	603	26,747	16,640
Delagoa Bay ...		405,924	266,900	356,399	377,979	456,566	525,404
Durban		174,514	182,710	141,979	102,371	595,537	432,951
West London ...		—	—	—	—	—	—
Mossel Bay ...		179	—	—	—	—	—
Port Elizabeth ...		—	—	—	—	—	—
Port Nolloth ...		—	—	—	—	—	—
Other Union Ports		—	—	—	11	66	13
TOTAL ...	764,313	581,438	452,267	505,032	480,964	1,078,916	975,008

*Exports of Coal from the Union of South Africa.** *(Foreign Produce.)*

Year.	Quantity (long tons).	Value. (£)
1913	327	272
1914	1	2
1915	10	43
1916	25	89
1917	699	1,639
1918	—	—
1919	—	—

Bunker coal shipped from the Union of South Africa.

Port of shipment.	Quantity (long tons).						
	1913.†	1914.	1915.	1916.	1917.	1918.	1919.
Capetown ...		143,271	206,947	499,403	460,531	294,075	267,432
Delagoa Bay		—	164,021	338,672	396,369	242,000	213,890
Durban ...		1,052,536	786,579	1,092,938	1,233,426	598,307	788,118
East London		3,073	364	87	—	—	—
Port Elizabeth		275	13	111	—	—	—
Port Nolloth		167	13	—	—	—	—
Other Union Ports		—	—	1,165	5,598	5,201	5,006
TOTAL ...	1,296,206	1,199,322	1,157,937	1,932,376	2,095,924	1,139,583	1,274,446

* Chiefly exported to the South West Africa Protectorate.
† Ports not stated in 1913.

Imports of Coal into the Union of South Africa.

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	36,737	36,141	12,672	482	1,389	53	116
Canada	—	—	—	212	—	—	—
India	—	—	273	—	—	—	—
Total from British Possessions	36,737	36,141	12,945	694	1,389	53	116
Germany...	347	246	871	—	—	—	—
Netherlands	50	50	—	—	—	—	—
Norway	554	329	40	—	—	—	—
United States	—	—	462	—	456	—	—
Japan	—	—	—	—	—	—	408
Total from Foreign Countries	951	625	1,373	—	456	—	408
TOTAL	37,688	36,766	14,318	694	1,845	53	524
	Value (£).						
United Kingdom ...	28,715	29,630	15,218	1,070	2,975	130	185
Canada	—	—	—	364	—	—	—
India	—	—	107	—	—	—	—
Total from British Possessions	28,715	29,630	15,325	1,434	2,975	130	185
Germany...	711	233	525	—	—	—	—
Netherlands	144	144	—	—	—	—	—
Norway	326	223	34	—	—	—	—
United States	—	—	334	—	457	—	—
Japan	—	—	—	—	—	—	408
Total from Foreign Countries	1,181	600	893	—	457	—	408
TOTAL	29,896	30,230	16,218	1,434	3,432	130	593

Production of Coke in the Union of South Africa.

Year.	Transvaal		Natal		Total	
	Quantity (long tons).	Value (£).	Quantity (long tons).	Value (£).	Quantity (long tons).	Value (£).
1913 ...	1,995	3,039	6,349	12,823	8,344	15,862
1914 ...	101	118	5,696	12,259	5,797	12,377
1915 ...	21	31	6,478	12,849	6,499	12,800
1916 ...	—	—	9,557	19,575	9,557	19,575
1917 ...	—	—	13,725	28,648*	13,725	28,648*
1918 ...	—	—	30,208	68,662†	30,208	68,662†
1919 ...	—	—	20,046	47,312‡	20,046	47,312‡

* Value of 13,715 tons sold.
† " " 28,338 " "
‡ " " 20,070 " "

NOTE.—Up to and including 1916, all coke produced was sold, and, for each year, the values given above represent those of the sales.

Production and Sales of Coke and By-Products in the Union of South Africa.

	Coke.*			Tar.†			Sulphate of Ammonia.‡		
	Production	Sales		Production	Sales		Production	Sales	
	(long tons).	(long tons).	(£).	gallons.	gallons.	(£).	(long tons).	(long tons).	(£).
1913... ...	8,344	8,344	15,862	43,293	43,293	1,433	—	—	—
1914... ...	5,797	5,797	12,337	2,225	2,225	124	—	—	—
1915... ...	6,499	6,449	12,880	26,050	26,050	881	—	—	—
1916... ...	9,557	9,557	19,575	—	—	—	—	—	—
1917... ...	13,725	13,715	28,648	—	—	—	—	—	—
1918... ...	30,208	28,338	68,662	—	—	—	2,929	2,235	86,299
1919... ...	20,046	20,070	47,312	21,153	1,465	135	2,805	3,359	102,930

* Produced in Natal.
† Produced entirely from gas-works in the Transvaal.
‡ There were no by-product coke ovens in South Africa, and the sulphate of ammonia was obtained from gas-producers, erected specifically for the purpose, the surplus gas being wasted.

Exports of Coke and Patent Fuel from the Union of South Africa.

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
British East Africa... ...	2	1	—	4	20	2	21
Egypt	—	—	—	—	—	—	591
Mauritius	—	—	—	—	62	564	281
South West Africa Protectorate	—	—	1	31	11	19	—
Zanzibar	—	—	—	—	—	5	5
Falkland Islands	—	—	—	—	—	—	93
Other British Possessions ...	—	—	—	1	—	53	8
Total to British Possessions	2	1	1	36	93	643	999
Belgian Congo	118	—	—	—	—	—	—
Madagascar	—	—	—	39	16	14	13
Portuguese East Africa ...	2	6	27	11	25	20	31
Other Foreign Countries ...	—	—	—	43	5	—	43
Total to Foreign Countries	120	6	27	93	46	34	87
TOTAL	122	7	28*	129	139	677	1,086
	Value (£).						
British East Africa... ...	2	2	—	15	77	10	80
Egypt	—	—	—	—	—	—	1,607
Mauritius	—	—	—	—	283	2,448	1,403
South West Africa Protectorate	—	—	2	66	21	61	—
Zanzibar	—	—	—	—	—	25	15
Falkland Islands	—	—	—	—	—	—	304
Other British Possessions ...	—	1	—	3	1	172	45
Total to British Possessions	2	3	2	84	382	2,716	3,454
Belgian Congo	264	—	—	—	—	—	—
Madagascar	—	—	—	202	83	90	50
Portuguese East Africa ...	4	21	82	34	119	86	101
Other Foreign Countries ...	—	—	—	140	21	—	156
Total to Foreign Countries...	268	21	82	376	223	176	307
TOTAL	270	24	84*	460	605	2,892	3,761

* Excluding 4 tons valued at £12 entered as "ships' stores."

Imports of Coke into the Union of South Africa.

Year.	Quantity (long tons).	Value (£).
1913	26,010	31,088
1914	23,739	28,070
1915	21,696	31,915
1916	20,677	41,068
1917	6,056	13,560
1918	224	634
1919	12	44

Imports of Patent Fuel into the Union of South Africa.

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom	183	111	23	11	5	3	—
Portuguese East Africa ...	26	128	536	110	14	7	161
Other Foreign Countries ...	—	2	—	—	—	—	—
Total from Foreign Countries	26	130	536	110	14	7	161
TOTAL	209	241	559	121	19	10	161
	Value (£).						
United Kingdom	2,873	2,137	34	127	7	38	6
Portuguese East Africa ...	42	71	895	301	16	21	283
Other Foreign Countries ...	38	36	—	—	—	—	—
Total from Foreign Countries	80	107	895	301	16	21	283
TOTAL	2,953	2,244	929	428	23	59	289

Transvaal.

The only area where coal is mined to any extent is that known as the High Veld, and the western portion of the coalfield, being nearest to Johannesburg and to the great mining districts of the Rand, is naturally the most developed. The mines are all shallow, the deepest being under 300 feet, and are free from gas.* The coal seams occur in the Karroo system. The coal is of comparatively good quality and is used on the Cape Government railways for steam-raising, and in Johannesburg for house and smiths' purposes.

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* With the exception of 82 tons in 1913 and 59 tons in 1914, which came from Belgium and Germany, this coke was entirely imported from the United Kingdom.

At present, Witbank is the principal colliery district of the Transvaal.† There are five known seams of coal, ranging from 1 to 20 feet in thickness, with an aggregate of 56 feet. The average thickness worked is about 8 feet, varying in different mines from 6 feet to 15 feet, and at least 12 per cent. of the coal mined is sorted out as waste. The coal discarded is dumped, and the dumps take fire immediately. The Main Coal, which is the lowest seam but one, is that most extensively worked, and a varying thickness at the bottom of the seam is of a fair coking quality.

The gold mines of the Transvaal used 1,594,382 tons of coal in 1918.

In addition to an extensive and increasing bunkering trade, a rapidly increasing oversea trade with India in Transvaal coal began in 1912, when 64,504 tons were exported. The export trade is still principally with India and the chief port of shipment is Lourenço Marques.

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* Coal Resources of the World, 1913, Vol. II, pp. 412–13.

† Official Year Book of the Union of South Africa, No. 3, 1919, p. 596.

Analyses of Transvaal Coals.

No.	Colliery.	Locality.	Proximate Analysis.					Ultimate Analysis.							Evaporative Power.	Specific Gravity.
			Fixed Carbon.	Volatile Matter.	Ash.	Sulphur.	Moisture.	Carbon.	Hydrogen.	Nitrogen.	Oxygen.	Sulphur.	Moisture.	Ash.		
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per lb.	
1	Anglo-French	Witbank District ...	60·15	24·65	13·02	0·85	1·33	68·54	4·52	1·43	10·31	0·85	1·33	13·02	12·77	—
2	Cassel-Landau		60·33	24·85	13·09	0·90	0·83	66·23	4·88	1·54	12·53	0·90	0·83	13·09	12·82	—
3	Clydesdale		58·26	26·06	13·72	0·87	1·09	66·16	4·78	1·54	11·84	0·87	1·09	13·72	12·87	—
4	Coronation		58·79	23·15	15·74	1·45	0·87	67·80	5·01	1·46	7·67	1·45	0·87	15·74	12·56	—
5	Mid. Steam		60·63	24·46	12·62	1·35	0·94	67·60	5·01	1·70	10·78	1·35	0·94	12·62	13·06	—
6	Station		60·79	22·99	13·51	1·58	1·13	66·83	5·21	1·10	10·64	1·58	1·13	13·51	13·08	—
7	Tavistock		60·35	24·88	12·30	1·38	1·09	69·24	3·60	1·57	10·82	1·38	1·09	12·30	13·08	—
8	T. & D. Bay		59·40	22·38	15·58	1·26	1·38	64·15	4·47	1·62	11·54	1·26	1·38	15·58	12·56	—
9	Uitspan		61·11	25·01	11·28	1·43	1·17	70·16	4·40	1·54	10·02	1·43	1·17	11·28	13·21	—
10	Witbank		56·96	27·04	13·82	1·24	0·94	66·10	5·16	1·51	11·23	1·24	0·94	13·82	13·01	—
	Average of ten Collieries ...		59·67	24·55	13·47	1·23	1·08	67·28	4·70	1·50	10·74	1·23	1·08	13·47	12·90	—
11	... ...	Heidelberg Coalfield	70·00 to 75·00	18·00 to 20·00	10·00 to 20·00	0·90 to 1·20	5·00 to 10·00	—	—	—	—	—	—	—	—	—
12	... ...	Witklip	61·50	14·03	14·75	—	9·72	—	—	—	—	—	—	—	—	1·70
13	... ...	Wilge River	56·15	34·24	3·05	0·46	6·10	—	—	—	—	—	—	—	—	1·30
14	Tenbosch (trial shaft) ...	Komati Poort Coalfield	58·34	6·13	33·24	0·96	1·33	—	—	—	—	—	—	—	4.10	—
15	Furley's Drift, 1st seam ...		68·75	4·84	24·52	1·30	0·59	—	—	—	—	—	—	—	11·22	1·68
16	" " 2nd seam ...		77·08	0·99	20·53	0·80	0·60	—	—	—	—	—	—	—	11·22	1·57
17	" " 3rd seam ...		61·80	1·39	35·83	0·48	0·50	—	—	—	—	—	—	—	9·28	1·78
18	" , 4th seam ...		71·28	1·39	26·47	0·36	0·50	—	—	—	—	—	—	—	10·78	1·72

Nos. 1 to 10.—The Transvaal Coal Owners' Association (1910), Limited, Report, 7th February, 1920.
11 to 13.—The Transvaal Coalfields, by R. Gascoyne, Transvaal Institute of Mining Engineers, Vol. XIII (1896-7), pp. 419, 422.
14 to 18.—Geology of the Komati Poort Coalfield, by H. Kynaston, Transvaal Mines Department. Geological Survey Memorandum No. 2, 1906, pp. 25-6.

Output of Coal in the Transvaal.

Year.	Output.			Sales.		
	Quantity mined (long tons).	Tons of waste sorted out of coal mined.	Percentage of waste sorted to tonnage mined.	Quantity sold (long tons)	Value at Pit's mouth. (£).	Value per ton.
						s. *d.*
1913	5,438,725	755,946	13·9	4,665,211	1,142,598	4 10·78
1914	5.294,019	618,956	11·69	4,604,703	1,150,746	4 11·98
1915	5,361,220	642,809	11·99	4,645,362	1,145,060	4 11·16
1916	6,478,454	889,548	13·73	5,479,387	1,382,680	5 0·56
1917	7,118,624	925,394	13·00	5,929,669	1,586,062	5 4·20
1918	6,796,325	766,851	11·3	5,749,072	1,632,361	5 8·14
1919	6,943,360	749,168	10·79	5,912,780	1,694,131	5 8·77

Cape Province.

The coal seams of Cape Colony are found in the Molteno beds of the Stormberg Series, but the coal is of very poor quality. In 1917 only 10,869 tons of coal were raised, obtained principally from the mines at Indwe. Early in that year the Indwe Colliery closed down, in consequence of the withdrawal of the railway contracts, on which, for a long time, the mines had been largely dependent. In 1918 the total coal production of Cape Province was only 4,589 tons.

According to information supplied by the Department of Overseas Trade (Development and Intelligence), His Majesty's Trade Commissioner, Cape Town, reports that lignite has been discovered at Van Rhyn's Dorp, 60 miles from the present termination, at Oliphants River, of the railway from Cape Town. It is stated that the railway through Namaqualand, for which surveys have been made, will pass through the property. The area of the deposit, although known to be very large, has not yet been estimated. A shaft has been sunk to a depth of about 100 feet, where the thickness of the seam of brown coal was found to measure about 14 feet.

An analysis of a sample of the coal taken from this shaft, made by Professor Marloth, gave the following results :—

	Per cent.
Combustible matter	81·9
Ash	12·6
Moisture	5·5
	100·0

Dry distillation of air-dried sample :—

	Per cent.
Crude oil and soft paraffin	10·7
Coke	70·6
Ammoniacal liquor	13·4
Gas	5·7

The coke contained 64·6 per cent. of total combustible matter, and gave a calorific value of 9,100 B.Th.U.

His Majesty's Trade Commissioner at Cape Town has forwarded to the Department of Overseas Trade a report relating to a deposit of lignite in the southern district of Cape Province, at Knysna Forest. It is stated that the site of the deposit is 16 miles from Knysna Harbour, and that the line of the South Western Railway runs through the property. It is estimated that the deposit covers an area of 8,000 acres, and contains 30 million tons of lignite.

Output of Coal in the Cape Province.

Year.	Output.			Sales.		
	Quantity mined (long tons).	Tons of waste sorted out of coal mined.	Percentage of waste sorted to tonnage mined.	Quantity sold (long tons).	Value at Pit's mouth (£).	Value per ton.
						s. d.
1913	73,329	13,083	17·84	60,251	38,752	12 10·36
1914	60,360	12,520	20·74	47,876	31,167	13 0·24
1915	52,863	11,028	20·86	41,830	26,591	12 8·57
1916	47,981	10,805	22·52	37,279	24,092	12 11·11
1917	10,869	592	5·45	7,411	5,950	16 0·70
1918	4,589	496	10·8	4,156	3,566	17 1·96
1919	5,718	788	13·79	4,249	3,750	17 7·81

Orange Free State.

Coal is mined at Coalbrook, also at Viljoen's Drift, to the north of Vaal River. Shafts sunk to the south of the Vaal have intersected the seams found to the north of the river, but at a depth nearly four times as great. The coal lies immediately above the Dwyka conglomerate which, here, rests unconformably on the Dolomite. As the latter is a water-bearing rock, the quantity of water to be dealt with in this area is sometimes very great. At Cornelia Colliery large flows of water have been dammed off and impounded in the Dolomite.

The chief producers in this province are the Cornelia Colliery on the Vaal River opposite Vereeniging, and the Clydesdale Colliery, about 15 miles to the south. There are also two small pits working at Vierfontein which supply the demands of the Kimberley mines. Not more than one workable seam has been discovered at any one point.

The average thickness of the coal worked is much the same at the different collieries, and may be taken at about 7 feet 6 inches.

The mines vary in depth from 70 feet at Vierfontein to as much as 500 feet at Clydesdale. A little gas is found in working the seam, but it is seldom of much consequence. The coals are fairly clean, and not much sorting is required. They are said to improve in quality towards the east.

Output of Coal in the Orange Free State.

Year.	Output.			Sales.		
	Quantity mined (long tons).	Tons of waste sorted out of coal mined.	Percentage of waste sorted to tonnage mined.	Quantity sold (long tons).	Value at Pit's mouth (£).	Value per ton.
						s. *d.*
1913	648,318	49,596	7·85	544,619	167,409	6 1·77
1914	705,744	36,340	5·15	624,301	191,064	6 1·45
1915	749,225	25,555	3·41	649,601	188,364	5 9·60
1916	788,012	33,872	4·3	680,871	198,699	5 10·04
1917	850,391	48,914	5·75	752,763	217,292	5 9·28
1918	827,154	40,879	4·94	738,015	229,736	6 2·70
1919	827,734	35,584	4·30	748,267	231,332	6 2·20

Natal.

The area of the district of Natal in which coal occurs is about 2,000 square miles, although probably not more than half of this area is coal-bearing.

*There are only two workable sections of from 2½ to 9 feet, and averaging from 4 to 6 feet in thickness. These two workable sections are made up of four different seams, and, owing to considerable variation in the thickness of the intervening strata, the working sections at the different mines are made up of one, two, or three of these component seams of coal.

The strata, consisting of shale and sandstone (Ecca Shales), which underlie the main seam of coal, have been bored to a further depth of over 400 feet at the South African collieries;

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* Trans. Inst. Min. Eng. (London), Vol. XVIII (1899–1900), p. 414. The Coalfields of Natal, by W. T. Heslop.

500 feet at the New Campbell collieries; and 562 feet at Kleinfontein, south of Elandslaagte, without proving any more workable coal. Although adits are adopted, where possible, the majority of the collieries are worked by shafts.

Throughout the entire coalfield the seams lie very nearly level, the inclination rarely exceeding 1 in 30 to the horizontal.

Extensive intrusions of igneous rock (dolerite or whinstone) form the most important feature of the coalfield, the whole of the northern district of Natal being intersected by vertical dykes and horizontal sheets of dolerite over very large areas of the country.

*These dykes vary from a few inches to many feet in thickness, and, sometimes, recur many times in a short distance. Not a single working colliery can lay claim to be free from disturbance by these intrusive dykes and sheets, and their effect is to alter all of the coal lying in their immediate proximity to an anthracite or semi-anthracite, the heat from the molten igneous rock driving off a portion of the volatile matter. No definite rule can be laid down to determine the distance to which a dyke or sheet affects the coal, but it has been found to be roughly proportionate to the thickness of the dyke.

Considerable activity prevailed during 1917 in the Vryheid district, which is about 45 miles north-east of Glencoe Junction. A new colliery (the Bernica) began to produce coal; and the Enyati Colliery was developed and progress made in the construction of the plant. In the Paulpietersburg area, some 25 miles farther to the north, the Northern Natal Navigation Colliery reached the producing stage.

Taking Hatting Spruit (some 6½ miles north of Glencoe Junction) as the centre of the coalfield, the distance by rail to Durban to which the bulk of the output goes is 240 miles.

†In Zululand, there are three isolated basins of coal-bearing strata, viz.: the Umlalaar River basin, the Intambanana and Somkele basin, and the Mahkabatini and Nongoma basin.

‡The Somkele, formerly known as the St. Lucia's Bay coalfield, is extensive and contains several seams of coal, one of them being 45 feet thick, but variable in character. Three

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* Trans. Inst. Min. Eng. (London), Vol. IV. Geology and Coal Deposits of Natal. R. A. S. Redmayne.

† Geological Survey of Natal and Zululand. Third and Final Report, 1907, p. 136.

‡ Trans. Inst. of Min. Eng. (London), Vol. XVIII, 1899, p. 425. The Coalfields of Natal, by W. T. Heslop.

samples taken, by the Commissioner of Mines, from selected parts of this seam, gave the following analyses :—

	No. 1. ft. in.	No. 2. ft. in.	No. 3. ft. in.
Coal	2 4	2 5	1 5
	Per cent.	Per cent.	Per cent.
Volatile matter... ...	10·9	11·2	10·2
Fixed carbon	80·0	75·8	75·5
Ash	6·1	12·2	13·0
Moisture	3·0	0·8	1·3

A colliery was started and worked at Somkele some 20 miles from the coast. The series of shales in which the coal seams occur is nearly 50 feet in thickness, and contains over 30 feet of coal in beds of varying thickness. Two seams were opened up, one near the bottom of the series of shales, the other near the top, and about 20,000 tons of coal were mined up to the end of 1905, but the coal was too anthracitic and dirty to enable the colliery to continue working with success.

Output of Coal in Natal.

Year.	Quantity mined (long tons).	Tons of waste sorted out of coal mined (long tons).	Percentage of waste sorted to tonnage mined.
1913	3,422,354	812,936	23·75
1914	3,064,894	750,321	24·48
1915	2,813,361	741,984	26·37
1916	3,651,442	889,838	24·37
1917	3,464,204	693,129	20·01
1918	3,064,094	575,929	18·80
1919	3,333,442	633,076	18·99

COKE.

The coke produced in Natal is of very fair quality, and, as little or no coke was imported recently into the country, and the local product proved quite satisfactory, the industry is likely to become established.

The erection of 30 Coppée non-regenerative by-product coke ovens, together with a large washing plant, was begun in 1919 near Marchbank Station, alongside the branch line from Burnside Colliery. It was expected that the plant would be in operation in 1921.

*Analysis of Vryheid (Natal) Coke.**

	Per cent.
Fixed Carbon	88·71
Ash	10·55
Sulphur	0·74
	100·00

BY-PRODUCTS.

*The Natal Ammonium, Ltd., at Mount Ngwibi, twenty miles from Vryheid, installed, during 1916, a complete plant for the production of ammonium sulphate from a highly nitrogenous anthracitic coal. The Company utilized practically the whole output from their colliery at Mount Ngwibi for this purpose. Production commenced in January, 1917.

During the nine months ended 30th September, 1917, 22,831 tons of coal were dealt with yielding 1,261 tons of ammonium sulphate, with an average content of 25 to 25½ per cent. of ammonia, which sold at £32 per ton, and was of high quality.

The initial difficulties of starting up such a large plant—the first of its kind in the country—with unskilled labour, and further difficulties as a result of the war, were largely overcome, and the output was increasing steadily. Owing to the anthracitic nature of the coal there was little tar, and this was mostly utilized in the works. All the power and lighting were obtained from the gas, the boilers being gas-fired. The surplus gas was being burnt to waste. The full plant, as originally contemplated, has not yet been erected, the capacity aimed at being 10,000 tons of ammonium sulphate per annum.†

Analysis of the Coal Used.

	Per cent.	
Moisture	1·67	
Volatile matter	9·18	On dried sample.
Fixed carbon	79·53	
Ash	11·28	
	99·99	

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* Industries Bulletin Series, Bulletin No. 28, Coal, by J. A. Wilkinson. 1919.

† The plant continued in operation until April, 1921, and was then closed down.

Analysis of the Coal Used—cont.

	Per cent.	
Nitrogen	2·212	On dried sample.
Sulphur	1·53	
Calorific value	13,500 B.Th.U.	
Specific gravity	1·452	

Analysis of Gas obtained.

	Per cent.	
Hydrogen	23·2	Total combustible 40·2 per cent.
Methane	5·4	
Carbon monoxide	11·6	
Carbon dioxide	14·8	
Oxygen	Nil.	
Nitrogen	45·0	
Net calorific value (calculated)	152 B.Th.U.	
Yield per ton	150,000 cub. ft.	

Analysis of Ash obtained.

	Per cent.
Potash, K_2O	0·71
Soda, Na_2O	0·09
Lime, CaO	3·15
Magnesia, MgO	1·35
Ferric oxide, Fe_2O_3	5·52
Alumina, Al_2O_3	32·99
Sulphur trioxide, SO_3	2·06
Phosphoric oxide, P_2O_5	0·44
Silica, SiO_2	54·06

*An interesting project, with possibilities of considerable development, is that of the South African Carbide and By-Products Company, Limited, whose works are at Ballengeich Colliery, near Newcastle, Natal. The works are designed for retorting the colliery waste at low temperatures, with the object of recovering tar-oils and motor spirit, the complete gasification of the resulting coke, and the recovery of ammonium sulphate in "Moore" producers. The gas from the producers will be burnt under the boilers in the power house, generating electricity for the carbide furnaces, and will, also, be for sale. The tar-oils will be distilled and worked up into products suitable for the South African market.

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* Information supplied by Mr. D. D. Drury, of Messrs. Harper Brothers & Co., Consulting Engineers.

Analyses of Natal Coals.

No.	Locality.	Moisture.	Vol. matter.	Fixed carbon.	Ash.	Nitrogen.	Sulphur.	Evap. power.	Analyst.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	lb.	
1.	Durban Navigation Collieries.	1·60	27·10	60·05	11·25	1·52	[1·51]	13·40	S. B. Bilbrough.
		1·55	30·35	58·70	9·40		[1·26]	13·84	
2.	Newcastle Colliery	3·35	29·00	56·63	10·08		1·43	13·98	
3.	Natal Steam Coal Co.	1·20	18·50	70·70	9·60			14·00	
4.	Ballengeich Collieries.	1·80	22·74	60·22	15·24	1·20	[1·26]	12·60	
5.	Natal Cambrian Collieries.	1·25	20 26	68·49	10·00				Bilbrough & Co., Johannesburg.
		1·25	22·20	68·25	8·30			14·43	
6.	Elandslaagte Collieries, Ltd.	1·45	19·00	68·50	11·05	2·16	[1·94]	13·63	
	Dundee Coal, Ltd.:								
7.	Burnside ...	[0·56]	24·30	68·40	7·30		[1·48]	15·05	W. H. Blake, Newcastle-on-Tyne.
	St. George's ...	[0·84]	25·30	68·94	5·76		[1·53]	15·23	
8.	———		16·63	70·53	8·66		4·18		
9.	Natal Navigation Collieries.	[0·92]	21·22	78·78	(*a*)	1·98	[1·06]	14·54	Ed. Riley, F.I.C. London.
10.	Do.	0·52	9·69	80·37	7·70		1·72		
		0·53	15·17	71·59	11·41		1·30		
11.	Northern Natal Navigation Collieries, Ltd.	1·80	26·80	64·00	7·40	1·82	[1·00]	14·04	Borough Analyst of Durban.
	Tendega Colliery, Ltd.:								
12.	Gus seam ...	1·30	24·00	67·10	7·60		[0·68]		
	Dundas seam...	1·50	22·70	66·30	9·50		[0·84]		
	Coking seam...	0·90	26·06	65·60	7·44		[0·63]		
13.	South African Collieries.	2·00	8·60	79·70	9·70				
	Between Natal Navigation Colliery and town of Newcastle:								
14.	Top coal seam	0·80	40·00	49·78	9·42				
	Bottom coal seam.	0·80	31·20	57·56	10·44				
15.	Caernarvon ground between Dannhauser and St. George's Colliery.	1·35	23·20	67·00	7·50		0·95		

(*a*) Ash included in fixed carbon.

Nos. 8, 10, 13–15.—The Coalfields of Natal, by W. T. Heslop, Trans. Institute of Mining Engineers (London), Vol. XVIII, p. 418-23.

Nos 1–7, 9, 11, 12.—South African Mining and Engineering Journal (Special Coal Number), December, 1919.

CANADA.

PEAT.

At a low estimate, there are about 37,000 square miles of peat bog in Canada, with an average depth of 5 to 10 feet, distributed as follows :—[†]

		Area in square miles.	Average depth in feet.
Nova Scotia and Cape Breton ...		250	8 to 10
Prince Edward Island...		10	8 „ 10
New Brunswick		250	8 „ 10
Quebec (in settled parts)		500	8 „ 10
Ontario („ „) ...	450		
Moose River Basin, &c. ...	10,000		
		10,450	5 „ 8
Manitoba		500	6 „ 10
[‡]North West Territory (estimated) ...		25,000	5 „ 10
British Columbia and Yukon Territory		No data	
		36,960	

A series of experiments on the "Utilization of Peat Fuel for the production of power" was conducted at the Fuel Testing Station, Ottawa, in 1910-1911. In connexion with these experiments, Mr. B. F. Haanel, Chief Engineer of the Division of Fuels and Fuel Testing, says :—

> "Speaking generally, it is safe to say that peat fuel for steam-raising cannot compete with good steam coal costing \$5 (20*s*. 10*d*.) or less a ton. But as the price of coal increases, as has been the case in the immediate past, and promises to do so at a more rapid rate in succeeding years, peat fuel for steam generation, wherever large deposits of peat suitable for fuel purposes are available, will become a very serious competitor of coal. Economy and efficiency, however, are the keynote of these modern times, and, in the future, it is hardly likely that any form of fuel will be utilized for steam generation for the production of power unless steam is indispensable to the carrying out of some chemical process, or other industry. So far as the generation of power is concerned, the more economical method to employ is the conversion of the peat fuel into a combustible gas which can, in this form, be burned in a gas engine or used for the different heating furnaces in metallurgical works.

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[*] Annual Reports of the Mineral Production of Canada.
Annual Reports on the Trade of Canada.

[†] Mineral Resources of Canada, Bulletin on Peat, by R. Chalmers, Geological Survey of Canada, 1904, p. 26.

[‡] In 1904, "North-West Territory" included Assiniboia, Saskatchewan, Alberta and Athabasca. "North-West Territories" now comprises the three districts known as Mackenzie, Keewatin and Franklin.

Many of the peats so far examined in this country have a very high nitrogen content, which can be recovered in the form of ammonia, when the peat is burned in a by-product recovery producer. In this manner, many of our peat bogs can become the source of one of the most valuable artificial fertilizers—ammonium sulphate—the demand for which is continually increasing."*

COAL.

Canada has very large supplies of coal and lignite, situate chiefly in the Atlantic and Pacific coast regions, the principal areas of production being Nova Scotia (coal), Alberta (coal and lignite, in about equal proportions), and British Columbia (coal).

The following table gives the geographical position of the several fields:—

	Latitude.	Longitude.
Nova Scotia :—		
Sydney field	46° 10′	60° 10′
Inverness field	46° 10′	61° 30′
Pictou field	45° 35′	62° 35′
Cumberland field	45° 40′	64° 20′
New Brunswick :—		
Grand Lake field	46° 05′	66° 00′
Manitoba :—		
Turtle Mountain field	49° 00′	100° 00′
Saskatchewan :—		
Estavan or Souris field	49° 05′	103° 00′
Alberta :—		
Belly River field	49° 40′	112° 40′
Blairmore-Frank field	49° 35′	114° 25′
Cascade field	51° 12′	115° 30′
Edmonton field	53° 50′	113° 30′
British Columbia :—		
Crowsnest field	49° 30′	114° 55′
Nicola Valley field	50° 20′	120° 50′
Telkwa Valley field	54° 30′	127° 10′
Nanaimo field, V.I.	49° 10′	123° 55′
Comox field, V.I.	50° 00′	125° 00′
Suquash field, V.I.	50° 37′	127° 15′
Graham island, Q.C.I.	53° 10′	132° 00′
Yukon Territory :—		
Tantalus field	62° 10′	136° 10′
Yukon River field	64° 30′	140° 00′

The coal production of Canada in 1913 amounted to 13,403,730 tons, valued at £7,778,112 or an average of 11*s*. 7*d*. per ton.

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* The Value of Peat Fuel for the Generation of Steam, by J. Blizard, Department of Mines, Canada. Bulletin No. 17, 1917, p. v.

This production was obtained by 227 operating companies, employing, on an average, 27,917 men, at a wages cost of approximately £4,596,904. This represented an increase of 445,847 tons, or 3·44 per cent. in quantity, compared with the previous year. The continuation of the labour troubles at the mines on Vancouver Island was responsible for a falling off in the production of British Columbia, and there was a slight reduction in that of the province of Saskatchewan. But the decreases in production were more than compensated by substantial increases in Alberta and Nova Scotia.

The extended use of oil fuel for locomotives in British Columbia, and for coast vessels, in some slight measure reduced the demand for coal in western Canada.

In 1914, there was a 10 per cent. decrease in coal production as compared with 1913. This was due, chiefly, to the unsettled industrial conditions existing generally throughout the Dominion, which were aggravated by the outbreak of the European War, and, in a lesser degree, to the decrease of ocean trade (particularly on the Pacific coast) during the first months of the war, due to the presence of enemy cruisers on the high seas.

In 1915, there was a decrease of about 11·6 per cent. in the production, compared with 1913; the average number of men employed being 24,574, a reduction of 12 per cent. The proportions of the total production contributed by the different provinces did not show any wide variations from the two previous years, and were approximately Nova Scotia, 56·26 per cent., Alberta, 25·33 per cent., British Columbia, 15·57 per cent., Saskatchewan, 1·81 per cent., New Brunswick and the Yukon, each less than one per cent.

In 1916, the production amounted to 12,931,603 tons (valued at £8,086,975, or an average of 12*s*. 6*d*. per ton), being an increase of 9·2 per cent. as compared with the previous year.

The average number of men employed during 1916 was 23,611, and the total wages paid £4,350,882. Compared with the previous year and with 1913, there was, thus, a decrease in the number of men employed of 963 and 4,306 respectively.

In 1917, there was a falling off in the total production of a little over three per cent , compared with the previous year, although the average number of men employed had increased by 985.

In 1918, the production rose to 13,373,148 tons, but it fell again in 1919 to 12,215,373 tons.

Although Canada possesses enormous resources of coal, over 50 per cent. of the consumption is imported from the United States. The Canadian coalfields are situated in the extreme eastern and western provinces, while the provinces of Ontario and Quebec, the chief centres of population, are more easily and economically supplied with coal from the nearer coalfields of Pennsylvania and Ohio. *There is no anthracite in eastern Canada, and, as it is considered the most desirable of the domestic, or house fuels, anthracite from Pennsylvania is extensively used for that purpose in Manitoba, Ontario and Quebec, and is imported even into the eastern coal districts.

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* The Mineral Production of Canada, Annual Report, 1917, p. 139.

Coal Control.—In view of the abnormal conditions prevailing in Canada, and also of the falling off of production in the United States during the previous year, and again, of the increasing difficulties of the transport situation, the Dominion Government, on July 12th, 1917, appointed C. A. Magrath as Fuel Controller for Canada, charging him, in the first place, with the duty of stimulating shipments to Canada, but, as the situation grew more serious, extending his powers until, later, they included the work of price-control, and, finally, that of Director of Coal Mining Operations in Canada.

Coal Imports.—The total imports of coal in 1913 amounted to 16,251,744 tons, valued at £9,989,400, as compared with 13,031,973 tons valued at £8,224,591 in 1912. The consumption in 1913 amounted to 28,198,701 tons, as compared with 24,107,143 tons in 1912, over one-half of the coal in each year being imported.

In 1914, the imports decreased to slightly below the 1912 level, while the total consumption fell to 23,975,288 tons, of which the quantity consumed by locomotives, during the year ending June 30th, 1914, was, 7,387,015 tons (equal to a decrease of 8·5 per cent. compared with the previous year).

In 1915, the total imports of coal again decreased by over two million tons, compared with the previous year, whilst the total consumption showed a decrease of about three million tons. However, in the following year (1916), they increased by 4½ million tons to 15,696,967 tons, valued at £7,977,014. The total consumption of coal also increased to 26,665,943 tons, as compared with 21,345,261 tons in the previous year.

In 1917, 18,622,732 tons of coal were imported, so that while production fell off, the imports considerably increased. The total consumption of coal in 1917 was 29,574,763 tons, an increase of nearly three million tons, compared with the previous year.

In 1918, 19,355,881 tons of coal were imported; importation as well as production showing an increase, compared with the previous year. The consumption of coal, in 1918, was 31,046,279 tons. Compared with the year 1913, the figures for 1918 show an increase in the quantity of coal imported of over three million tons, and of nearly three millions in the consumption, the production having decreased by only thirty thousand tons.

In 1919, the imports and consumption of coal fell to 15,454,319 and 25,770,551 tons, respectively.

Coal Exports.—The exports of coal of domestic production in 1913 amounted to 1,394,661 tons, valued at £825,281 (or an average of 11*s.* 10*d.* per ton), as compared with 1,899,226 tons, valued at £1,212,832, in 1912. In 1919 they amounted to 1,848,259 tons, valued at £2,591,434, or an average of 28*s.* per ton compared with 1913, there was, in 1919, an increase in quantity of 453,598 tons, and of £1,766,153 in value, and an increase of 16*s*. 2*d*. in the average value per ton.

The total production of coal and lignite in Canada in 1917 included :—

			Percentage of total.
96,629 long tons of anthracite	...	(less than)	1
9,959,153 ,, ,, bituminous	...		79
2,485,967 ,, ,, lignite	...		20
			100

The actual amount of each class of coal produced prior to 1917 is not given in " Mineral Production of Canada," but the following statement is made :—

" Bituminous coal constitutes by far the largest proportion of the annual production. Lignite only is produced in Saskatchewan, and in Alberta it forms a large proportion of the Province's production. Of anthracite, there is a small output, less than 200,000 tons annually, from one mine, at Bankhead, Alberta." Anthracitic coal has been found at Groundhog Mountain in British Columbia.

COKE.*

Coke is produced principally in Nova Scotia, Ontario and British Columbia; the Ontario coke is manufactured entirely from imported coal.

Sixty-seven per cent. of the coke output of Canada is being produced from two large by-product coke oven plants at Sault Ste. Marie, Ontario, and at Sydney, Nova Scotia; and since the outbreak of the war, a benzol recovery installation has been added to the Sydney plant. In western Canada there are numerous beehive coke ovens.

In 1913, the total quantity of coke manufactured was 1,354,583 tons, as compared with 1,255,382 tons in 1912. It is estimated that £180,448 worth of by-products were recovered at the by-product coking plants in the Dominion.

During 1914 the output fell off heavily, and there was a decrease of 448,107 tons, compared with the previous year. At the close of the year, there were only 797 ovens in operation, as against 2,297 idle.

In 1916, the total output of oven-coke was 1,293,555 tons.

In 1917, the total output of oven-coke was 1,099,879 tons, made from 1,722,253 tons of coal, of which 1,231,284 tons were of domestic origin. At the close of the year 1,657 ovens were in operation, and 875 were idle. Of the total output of coke, 816,443 tons were made in by-product ovens, the by-products recovered including sulphate of ammonia, benzol, toluol, naphtha and naphthalene. There was, however, a decrease in the quantity, both of sulphate of ammonia and of tar, of 981 tons and 735,124 gallons, respectively, compared with the previous year.

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* Annual Reports of the Mineral Production of Canada.

In 1918, 1,123,468 tons of coke were produced from 1,770,752 tons of coal, of which 1,203,779 tons were of domestic origin, and 566,973 tons were imported. The output averaged 0.634 tons of coke per ton of coal used. The total coke used, or sold by producers during the year, was 1,116,736 tons, valued at £2,298,999 (partly estimated), or an average of £2 1*s.* 2*d.* per ton. At the close of the year 1,560 ovens were in operation, 1,041 were idle, and 115 were being built. Of the total output of coke, 784,878 tons, or 71.2 per cent., were made in by-product ovens.

Compared with 1913, the output of coke in 1918 showed a decrease of 231,115 tons.

The imports of coke increased from 560,870 tons, in 1912, to 646,345 tons in 1913, while the exports continued to be relatively insignificant. The consumption of coke in Canada is much in excess of the domestic production, and there is a considerable importation of coke, chiefly into Ontario and Quebec, for use in the metallurgical industries. Adding the sales, 1,366,517 tons, to the net imports, 585,421 tons, gives a consumption of 1,951,938 tons, which, however, decreased by 30.07 per cent. during 1914, the consumption in that year being the smallest since 1909. The two following years, however, showed increases of 17 and 23 per cent. respectively.

In 1917, the imports of coke were 866,166 tons, the total consumption amounting to 1,957,476 tons, being an increase of 12,549 tons, compared with the previous year.

In 1918, the imports of coke amounted to 1,040,705 tons, being an increase of 394,360 tons, compared with 1913. The consumption amounted to 2,131,002 tons, an increase of 179,064 tons over that of 1913.

In 1919, the imports and consumption of coke were 342,298 tons and 1,341,379 tons, respectively.

The exports of coke in 1913 amounted only to 60,924 tons, and were derived entirely from British Columbia and Alberta. By 1919, they had fallen to 13,133 tons, a decrease of over 78 per cent.

BY-PRODUCTS.

The recovery of by-products from coke-ovens in 1918 included 8,009,327 gallons of tar, 9,665 tons of sulphate of ammonia, and an important quantity of other substances. Compared with 1913, the increase in the extraction of sulphate of ammonia was 194 tons, while there was a decrease of 362,273 gallons in the quantity of tar.

Table showing the principal Peat Bogs of Canada, and analyses of Peat.

Analyses of Canadian Fuels, Canadian Department of Mines, Mines Branch, 1918.

Province.	Name of Bog.	Situation and County.	Area.	Proximate Analysis.			Sulphur.	Nitrogen.	Calorific Value.	Fuel Ratio.
				Ash.	Volatile Matter.	Fixed Carbon.				
			Acres.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	B.Th.U.	
Nova Scotia	Caribou	Berwick, King's County	887	7·7	62·6	29·7	0·4	1·6	9,790	0·47
	Cherryfield	Lunenburg County	160	6·1	64·1	29·8	0·3	1·1	9,450	0·47
	Clyde	Clyde River, Shelburne County	2,240	7·0	64·0	29·0	0·3	1·4	9,510	0·45
	Port Clyde	Shelburne County	1,666	3·0	66·6	30·4	0·3	1·1	9,730	0·46
	Latour	Port Latour, Shelburne County	849	3·8	68·0	28·2	0·3	1·1	9,280	0·42
	The Heaths	Lower Argyle, Yarmouth County	2,174	8·9	60·9	30·2	0·4	1·7	9,410	0·50
	Makoke	Tusket, Yarmouth County	460	6·1	65·0	28·9	0·4	1·6	9,320	0·44
	Tusket	Tusket, Yarmouth County	235	12·7	59·5	27·8	0·5	1·8	9,130	0·47
Prince Edward Island	Mermaid	Charlottetown, Queen's County		3·6	67·1	29·3	—	0·9	9,580	0·44
	Miscouche	St. Nicholas Station, Prince County		5·7	62·8	31·5	0·3	1·3	9,550	0·50
	Black Marsh	Tignish, Prince County		4·4	64·5	31·1	0·3	0·8	9,860	0·48
New Brunswick	Seeley Cove	Pennfield, Charlotte County		3·4	64·4	32·2	1·1	1·0	9,420	0·50
	Hunter	Pennfield, Charlotte County		3·1	66·9	30·0	0·3	1·1	9,490	0·45
	Pocotogan	Pennfield, Charlotte County		2·3	65·9	31·8	0·3	1·0	9,000	0·48
	St. Stephens	Charlotte County		11·6	61·0	27·4	6·4	1·5	8,620	0·45
	Haymans	St. Stephens, Charlotte County		6·2	61·0	31·0	0·8	1·4	9,380	0·51
	Gitchell Settlement	Charlotte County		48·0	36·7	14·4	1·2	1·5	5,050	0·39
Quebec	Large Tea Field	Huntingdon, Huntingdon County	5,268	5·6	65·2	29·2	—	1·6	9,290	0·45
	Small Tea Field	Huntingdon, Huntingdon County	4,190	4·7	64·9	30·4	—	1·7	8,940	0·47
	Lanoraie	Lanoraie, Joliette, and Berthier Counties	7,500	9·2	64·4	26·4	—	2·0	8,900	0·41
	St Hyacinthe	St. Hyacinthe and Bagot Counties	3,890	6·6	62·9	30·5	—	1·9	8,800	0·49
	Rivière de Loup	Rivière de Loup, Temiscouata County	7,220	2·8	69·2	28·0	—	1·0	9,110	0·40
	Cacouna	Cacouna, Temiscouata County	845	6·0	65·7	28·3	—	1·6	9,520	0·43
	Leparc	Leparc	614	2·7	69·5	27·8	—	0·9	9,000	0·40
	St. Denis	St. Denis	315							

	Rivière Ouelle	Rivière Ouelle, Kamouraska County ...	4,251	3·3	67·9	28·8	—	1·1	9,080	0·42
	Les Bergeronnes ...	Saguenay County								
	Pont Rouge	Pontneuf		3·1	71·5	25·4	—	—	8,330	0·35
	L'Assomption	L'Epiphanie, L'Assomption County ...	1,565	5·2	66·1	28·7	0·1	1·6	9,660	0·44
	Canrobert	Rouville County		3·0	68·6	28·4	0·2	1·6	9,560	0·41
	Industrial Peat Co., Ltd.	Farnham		5·3	65·8	28·9			9,770	0·44
	Farnham...	Iberville and Missisquoi Counties ...		4·7	64·7	30·6	0·2	1·7	9,620	0·47
	Girard	St. John's County		5·2	62·6	32·2	0·4	1·6	9,480	0·51
	Napierville	Napierville County		11·4	61·1	27·5	0·4	2·4	8,400	0·45
	St. Isodore	La Prairie, Chateauguay and Napierville Counties	1,231	6·8	61·6	31·6	0·4	2·0	8,920	0·51
	Holton	Chateauguay and Napierville Counties...	6,181	13·4	59·3	27·3	1·2	2·5	8,530	0·46
Ontario ...	Government	Alfred, Prescott County		5·4	64·4	30·2	0·2	1·5	9,520	0·47
	Moose Creek	Stormont County	9	9·7	60·7	29·6	0·5	2·0	8,390	0·49
	Richmond	Carleton County		12·0	59·9	28·1	—	2·0	8,750	0·47
	Meath	Renfrew County		20·4	56·9	22·7	1·1	3·0	7,960	0·40
	Westmeath	Renfrew County		9·2	59·3	31·5	0·5	1·7	8,470	0·53
	Stoco	Hastings County		14·7	61·1	24·2	—	2·2	7,910	0·40
	Manilla	Mariposa, Victoria County		11·3	59·9	28·8	0·6	2·1	8,100	0·48
	Sunderland	Ontario County		11·2	60·5	28·3	0·6	2·0	8,280	0·47
	Holland	Bradford, Simcoe and York Counties ...		19·3	59·5	21·2			7,610	0·36
	Marsh Hill	Ontario County		10·8	61·8	27·4	0·8	2·4	8,180	0·44
	Amaranth	Crombie, Dufferin County		12·9	59·9	27·2	0·3	1·7	8,710	0·45
	Luther	Grand Valley, Dufferin and Wellington Counties		2·7	67·2	30·1	—	0·8	9,360	0·45
	Westover	Wentworth County		20·3	55·6	24·1	1·3	2·3	7,920	0·43
	Cargill	Bruce County		26·3	51·6	22·1	0·5	2·1	7,400	0·43
	Fort Frances	Rainey River County		8·7	62·4	28·9	—	1·7	8,910	0·46
	Bogs on T. & N.O. Rly.	South of Cochrane		—	—	—	—	—	9,530	—
Manitoba ...	Litter	2 miles from Point Dubois		7·7	66·1	26·2	0·2	1·6	9,090	0·40
	Mud Lake	3 miles from Point Dubois		7·7	69·1	23·2	—	1·5	8,760	0·34
	Rice Lake	7½ miles from Point Dubois		56·1	34·8	9·1	—	1·8	—	0·26
	Buggy Creek	12 miles from Point Dubois		8·3	65·0	26·7	—	—	8,730	0·41
	Transmission	18 miles from Point Dubois		19·0	56·8	24·2	—	1·6	—	0·43
	Whitemouth	Whitemouth		19·5	55·4	25·1	0·4	2·2	7,940	0·45
	Lac du Bonnet	Near Lac du Bonnet		15·6	50·4	25·0	—	1·4	7,190	0·42
	Big Grass Marsh ...	At Gladstone		46·7	43·4	9·9		2·0	—	0·23

Production of Peat in Canada.

Year.	Quantity (long tons).	Value* (£).
1913	2,321	2,104
1914	612	515
1915	268	219
1916	268	312
1917	—	—
1918	—	—
1919	880	1,367

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* Values converted to £ sterling at the rate of 1 dollar = 4*s.* 2*d.*

*Coal Resources of Canada.**

District.	Including seams of 1 ft. or over, to a depth of 4,000 ft.					Including seams of 2 ft. and over, at depths between 4,000 and 6,000 ft.	
	Actual reserve. (Calculation based on actual thickness and extent.)			Probable reserves. (Approximate estimate.)		Probable reserves. (Approximate estimate.)	
	Area. Sq. miles.	Class of coal.	Tons.	Area. Sq. miles.	Tons.	Area. Sq. miles.	Tons.
Nova Scotia	174	Bituminous	2,188,151,000	204	4,911,817,000	73	2,639,000,000
New Brunswick	—	Bituminous	—	121	151,000,000	—	—
Ontario	—	Lignite	—	10	25,000,000	—	—
Manitoba	—	Lignite	—	48	160,000,000	—	—
Saskatchewan	306	Lignite	2,412,000,000	13,100	57,400,000,000	—	—
Alberta	25,300	Lignite	382,500,000,000	56,375	491,271,000,000	—	—
		Bituminous	3,223,800,000		182,183,600,000	203	12,700,000,000
		Anthracite	669,000,000		100,000,000	—	—
British Columbia ...	439	Anthracite and bituminous	23,771,242,000	6,196	44,907,700,000	11	2,160,000,000
		Lignite	60,000,000		5,136,000,000	—	—
Yukon	—	Anthracite and bituminous	—	2,840	250,000,000	—	—
		Lignite	—		4,690,000,000	—	—
†North-West Territory...	—	Lignite	—	300	4,800,000,000	—	—
Arctic Islands	—	Bituminous	—	6,000	6,000,000,000	—	—
Totals	26,219		414,804,193,000‡	85,194	801,986,117,000	287	17,499,000,000

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* Coal Resources of the World, Vol. II, 1913.

† In 1904, "North-West Territory" included Assiniboia, Saskatchewan, Alberta, and Athabasca. "North-West Territories" now comprises the three districts known as Mackenzie, Keewatin and Franklin.

‡ 20,000,000 tons has been deducted from the total for the amount of coal of all classes mined in Alberta to 1911.

*Average Analyses of Canadian Coals.**

Coalfield.	Total moisture in coal.	Proximate analysis of dry coal.			Ultimate analysis of dry coal.					Calorific value of dry coal.	Fuel ratio.	Ratio of Carbon to Hydrogen.
		Fixed carbon.	Volatile matter.	Ash.	Carbon.	Hydrogen.	Sulphur.	Nitrogen.	Oxygen.			
NOVA SCOTIA :—	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cals.		
Sydney, Cape Breton Co. ...	3·7	56·3	36·4	7·3	75·8	5·1	2·8	1·4	7·5	7,590	1·55	14·9
Inverness County	7·0	49·0	38·5	12·5	65·4	4·5	6·9	0·9	9·8	6,650	1·27	14·5
Picton, Pictou County	2·4	57·5	29·6	12·9	73·0	4·5	1·2	1·9	6·5	7,210	1·94	16·2
Springhill, Cumberland ...	2·6	59·0	33·0	8·0	76·6	4·9	1·5	1·6	7·4	7,510	1·79	15·6
Joggins, Chignecto, Cumberland	2·9	46·4	37·8	15·8	64·8	4·4	6·2	1·2	7·6	6,590	1·23	14·7
NEW BRUNSWICK :—												
Grand Lake, Queen's County ...	1·3	53·4	32 2	14·4	70·3	4·6	5·8	0·6	4·3	7,160	1·66	15·3
MANITOBA AND SASKATCHEWAN:—												
Souris	29·7	43·1	44·5	12·4	58·7	4·6	0·6	1·0	22·7	5,650	0·97	12·8
ALBERTA :—												
Edmonton	22·9	49·6	40·3	10·1	64·6	4·5	0·4	1·3	19·1	6,100	1·23	14·3
Belly River	8·8	47·2	34·5	18·3	61·9	4·6	1·1	1·6	12·5	6,030	1·37	13·5
Blairmore-Frank	1·9	56·8	26·3	16·9	70·7	4·2	0·6	1·0	6·6	6,830	2·16	16·8
Cascade	1·5	71·6	14·7	13·7	76·6	3·7	0·6	1·1	4·3	7,270	4·87	20·7
BRITISH COLUMBIA :—												
Crowsnest	2·3	64·2	24·6	11·2	76·8	4·5	0·5	1·2	5·8	7,440	2·61	17·1
Similkameen	2·6	53·2	32·7	14·1	70·4	4·5	1·9	—	—	—	1·62	15·6
Nicola Valley	3·7	47·2	39·1	13·7	68·3	5·0	0·8	1·6	10·6	6,620	1·21	13·6
VANCOUVER ISLAND :—												
Nanaimo Comox	2·1	52·3	36·5	11·2	72·3	4·6	0·9	1·1	9·9	7,150	1·43	15·7
Albert Bay	7·0	42·7	34·3	23·0	—	—	—	—	—	6,170	1·24	—
YUKON TERRITORY :—												
Whitehorse	—	56·0	26·5	17·5	70·4	4·2	0·5	0·8	7·6	6,600	2·12	16·8

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* Investigation of the Coals of Canada, Department of Mines, 1912, Vol. VI, Table VII.
Coal Fields of British Columbia, Department of Mines, Mem. 69, 1915.

Characteristic Analyses of Canadian Coals.[*]

Coalfields.	Collieries.	Condition of Samples.	Proximate Analysis.				Ultimate Analysis.					Calorific Value.
			Moisture.	Fixed carbon.	Volatile matter.	Ash.	Carbon.	Hydrogen.	Nitrogen.	Oxygen.	Sulphur.	
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
NOVA SCOTIA COALFIELD:—												
Sydney Area	North Atlantic Collieries, Ltd., Port Morien.	D	—	53·0	34·7	12·3	70·5	4·8	1·0	5·0	6·4	7,010
Sydney Area	Dominion Coal Company, Ltd., Glace Bay.	AD	2·4	54·8	33·8	9·0	73·6	5·1	1·1	8·7	2·5	7,320
Sydney Area	Dominion Coal Company, Ltd., Dominion No. 1 Colliery, Glace Bay.	D		59·8	34·3	5·9	78·6	5·1	1·5	7·1	1·8	7,780
Sydney Area	Nova Scotia Steel and Coal Company, Ltd., Sydney No. 1 Colliery, Sydney Mines.	D		56·3	40·2	3·5	79·3	5·4	0·9	9·0	1·9	8,050
Pictou Area	Acadia Coal Company, Ltd., Stellarton, Allam Shaft Colliery, Stellarton.	D		55·4	33·3	11·3	74·1	4·6	1·9	7·5	0·6	7,350
Pictou Area	Intercolonial Coal Mining Company, Ltd., Drummond Colliery, Westville.	D		63·4	25·3	11·3	76·0	4·5	2·0	4·9	1·3	7,530
Springhill Area	Dominion Coal Company, Ltd., No. 1 Colliery, Springhill.	D		63·3	33·3	3·4	81·5	5·1	1·9	7·2	0·9	7,880

NOTE.—AD means "air-dried" sample. D means sample dried at 105° Cent.

[*] Analyses of Canadian Fuels, Canada Department of Mines, Mines Branch, 1918.

*Characteristic Analyses of Canadian Coals**—continued.

Coalfields.	Collieries.	Condition of Samples.	Proximate Analysis.				Ultimate Analysis.					Calorific Value.
			Moisture.	Fixed carbon.	Volatile matter.	Ash.	Carbon.	Hydrogen.	Nitrogen.	Oxygen.	Sulphur.	
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
NOVA SCOTIA COALFIELD—*cont.*—												
Joggins-Chignecto Area...	Maritime Coal, Railway and Power Co., Ltd., Joggins Colliery, Old Mine, Joggins Mines.	D		51·6	38·1	10·3	70·3	4·9	0·9	8·8	4·8	7,080
NEW BRUNSWICK COALFIELD:—												
Grand Lake Area ...	G. H. King's Mine, New Brunswick Colliery, Minto.	D		53·4	32·2	14·4	70·3	4·6	0·6	4·3	5·8	7,160
SASKATCHEWAN COALFIELD:—												
Estevan Area	Western Dominion Collieries, Ltd., Taylorton, Taylorton Mine.	D		47·9	42·7	9·4	64·7	4·5	1·1	19·6	0·7	6,010
Estevan Area	Saskatchewan Coal, Brick & Power Co., Shand, Shand Mine.	AD	26·9	35·7	27·8	9·6	45·6	5·8	0·8	37·8	0·4	4,240
Estevan Area	Estevan Coal and Brick Company, Ltd., Estevan.	D		43·2	40·0	16·8	57·7	4·3	0·9	19·8	0·5	5,360

Alberta Coalfield :—												
Crowsnest Pass Area ...	International Coal and Coke Co., Ltd., Denison Colliery.	D		62·0	26·4	11·6	76·5	4·3	1·0	6·2	0·4	7,320
Crowsnest Pass Area ...	Franco-Canadian Collieries, Ltd., Frank.	AD	1·0	59·8	28·5	10·7	77·4	5·0	1·2	5·2	0·5	7,380
Crowsnest Pass Area ...	West Canadian Collieries. Ltd., Blairmore, Lille Colliery.	D		58·6	25·0	16·4	71·2	4·2	0·9	6·8	0·5	6,930
Canmore-Banff Area ...	Canmore Coal Co., Ltd., No. 2 Mine, Canmore.	AD	0·9	79·7	14·0	5·4	85·2	4·2	1·3	3·0	0·9	8,040
Brazeau Area	Brazeau Collieries, Ltd., Nordegg.	AD	0·9	70·6	16·5	12·0	78·7	4·2	1·1	3·6	0·4	7,490
Mountain Park Area ...	Mountain Park Coal Co., Ltd., Mountain Park.	AD	1·9	62·9	30·9	4·3	82·3	5·3	1·3	6·4	0·4	8,000
Jasper Park Area ...	Jasper Park Collieries, Ltd., Miette Mine, Pocohontas.	AD	0·5	58·9	18·8	21·8	68·1	3·9	1·1	4·3	0·8	6,550
Yellowhead Pass Area ...	North American Collieries, Ltd., Edmonton, Pacific Pass Colliery, Lovettville.	AD	7·5	54·6	30·3	7·6	67·6	5·3	1·0	18·3	0·2	6,380
Lethbridge-McGrath Area	C. P. Ry., Nat. Resources Dept., Calgary, Galt No. 6 Mine, Lethbridge.	AD	8·9	47·7	33·7	9·7	63·5	5·5	1·5	19·3	0·5	6,100
Pembina—Wabamun Area	Security Coal Mines, Wabamun.	AD	13·8	46·9	33·6	5·7	58·9	5·1	0·7	29·4	0·2	5,300
Taber—Bow Island Area	Regal Coal Co., Ltd., Eureka Mine, Taber.	AD	14·0	46·8	31·8	7·4	60·5	5·8	1·5	23·6	1·2	5,680
Camrose — Battle River Area.	J. B. Turner's Mine, Hastings Coulee.	AD	21·3	43·7	29·6	5·4	54·1	6·1	1·2	32·8	0·4	5,090

Note. —AD means "air-dried" sample. D means sample dried at 105° Cent.
* Analyses of Canadian Fuels, Canada Department of Mines, Mines Branch, 1918.

*Characteristic Analyses of Canadian Coals**—continued.

Coalfields.	Collieries.	Condition of Samples.	Proximate Analysis.				Ultimate Analysis.					Calorific Value.
			Moisture.	Fixed carbon.	Volatile matter.	Ash.	Carbon.	Hydrogen.	Nitrogen.	Oxygen.	Sulphur.	
			Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Calories.
ALBERTA COALFIELD—*cont.*												
Edmonton — Clover Bar Area.	The Clover Bar Coal Co., Ltd., Clover Bar.	AD	17·6	46·6	27·8	8·0	55·2	5·4	1·1	29·9	0·4	5,070
Cardiff—Namao Area ...	Cardiff Collieries, Ltd., Cardiff.	AD	19·3	40·7	31·9	8·1	52·6	6·3	1·1	31·7	0·2	4,920
Peace River Area ...	Ray's Mine, Red Willow Creek, Halcourt.	AD	10·7	53·5	31·7	4·1	47·9	5·6	1·8	20·2	0·4	6,610
BRITISH COLUMBIA COALFIELD :—												
Crowsnest Pass Area ...	Crowsnest Pass Coal Co., Ltd., Michel Colliery, Michel.	D		68·6	25·2	6·2	82·4	4·8	1·3	4·8	0·5	7,950
Crowsnest Pass Area ...	Canadian Pacific Railway Natural Resources Department, Hosmer Mine, Hosmer.	D		62·0	25·6	12·4	75·9	4·5	1·2	5·4	0·6	7,270
Nicola Area	Middlesboro Collieries, Ltd., Merritt.	D		50·2	39·8	10·0	70·8	5·3	1·5	11·5	0·9	7,010
Nanaimo Area	Canadian Collieries (Dunsmuir), Ltd., Ladysmith, Wellington Extension Colliery.	D		50·3	41·2	8·5	75·3	5·2	1·2	9·4	0·4	7,430
YUKON COALFIELDS ...	White Pass and Yukon Railway Co., Ltd., Tantalus Mine, Tantalus.	D		56·0	27·8	16·2	71·1	4·3	0·7	7·2	0·5	6,790

NOTE.—AD means "air-dried" sample. D means sample dried at 105° Cent.

*Analyses of Canadian Fuels, Canada Department of Mines, Mines Branch, 1918.

Output, Production, Imports, Exports, and Consumption of Coal in Canada.

—	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Output	13,868,641	12,489,949	12,035,889	13,228,306	12,888,715	13,803,915	12,572,013
Production by Provinces—							
Nova Scotia	7,125,065	6,581,182	6,663,723	6,171,554	5,649,188	5,195,145	5,107,476
New Brunswick	62,778	87,544	113,742	128,161	168,835	239,475	159,918
Saskatchewan	190,086	207,410	214,381	251,161	317,362	309,685	339,437
Alberta	3,584,603	3,288,406	3,000,730	4,070,584	4,228,900	5,332,871	4,432,620
British Columbia	2,423,589	1,999,820	1,844,298	2,307,197	2,173,114	2,293,383	2,174,940
Yukon	17,609	12,003	8,682	2,946	4,350	2,589	982
TOTAL	13,403,730	12,176,365	11,845,556	12,931,603	12,541,749	13,373,148	12,215,373
Production by kinds—							
Anthracite ... ... }			10,253,385	10,903,635	96,629	103,040	99,396
Bituminous ... ... }					9,959,153	10,389,455	9,502,591
Lignite			1,592,171	2,027,968	2,485,967	2,880,653	2,613,386
Imports—							
Bituminous†	9,592,387	6,943,228	5,452,495	8,486,207	11,078,112	12,193,179	9,042,826
Bituminous‡	2,514,663	2,240,743	2,041,889	3,129,675	2,794,443	2,890,238	1,989,462
Anthracite	4,144,694	3,959,830	3,635,886	4,081,085	4,750,177	4,272,464	4,422,031
TOTAL	16,251,744	13,143,801	11,130,270	15,696,967	18,622,732	19,355,881	15,454,319
Exports—							
Domestic Produce	1,394,661	1,270,648	1,577,270	1,906,571	1,547,461	1,622,495	1,848,259
Foreign Produce	62,112	74,230	53,295	56,056	42,257	60,255	50,882
Consumption	28,198,701	23,975,288	21,345,261	26,665,943	29,574,763	31,046,279	25,770,551

† Round and run-of-mine.

‡ Slack such as will not pass through ¾ inch screen.

Output, Production, Imports, Exports, and Consumption of Coal in Canada—continued.

—	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
	Value* (£).						
Production by Provinces—							
Nova Scotia	3,710,971	3,427,699	3,470,689	3,857,221	4,043,904	4,394,890	4,599,734
New Brunswick	34,716	50,224	64,503	80,420	147,502	277,440	165,575
Saskatchewan	74,623	77,968	76,093	92,049	138,011	150,447	170,942
Alberta	2,170,613	1,947,998	1,725,642	2,372,204	2,948,684	4,278,601	3,811,353
British Columbia	1,767,200	1,458,203	1,344,800	1,682,331	1,715,774	2,394,725	2,587,593
Yukon	19,989	11,200	8,103	2,750	6,090	2,417	917
TOTAL	7,778,112	6,973,292	6,689,830	8,086,975	8,999,965	11,498,520	11,336,114
Production by kinds—							
Anthracite ... ... Bituminous ... ... }			5,809,954	6,900,373	7,366,650	9,368,311	9,241,134
Lignite			879,876	1,186,602	1,633,315	2,130,209	2,094,980
Imports—							
Bituminous†	4,532,637	3,115,484	1,575,910	2,576,808	7,023,520	7,768,970	5,156,399
Bituminous‡	866,171	751,094	422,345	771,797	1,820,807	1,739,925	1,002,997
Anthracite	4,590,592	4,425,401	3,907,079	4,628,409	5,856,164	5,418,310	6,582,436
TOTAL	9,989,400	8,291,979	5,905,334	7,977,014	14,700,491	14,927,205	12,741,832
Exports—							
Domestic Produce	825,281	808,370	1,126,262	1,479,039	1,538,999	1,959,463	2,591,434
Foreign Produce			17,929	31,416	36,078	42,789	32,750
Consumption			11,450,973	14,553,534	22,125,379	24,423,473	21,453,762

* Values converted to £ sterling at the rate of 1 dollar = 4*s.* 2*d.*

† Round and run-of-mine.

‡ Slack such as will not pass through ¾ inch screen.

Distribution of Coal mined in Canada.

	Quantity (long tons).						
—	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Sold in Canada	10,162,464	9,249,455	8,773,850	9,554,938	9,347,739	10,008,200	9,301,484
Sold for export to United States	1,120,894	1,054,943	1,188,141	1,295,603	1,162,394	1,209,548	888,099
Sold for export to other countries	234,990	214,221	265,485	254,029	268,804	248,490	521,977
Total sales	11,518,348	10,518,619	10,227,476	11,104,570	10,778,937	11,466,238	10,711,560
Used by producers for the manufacture of coke*	816,447	527,974	626,763	718,584	616,583	624,200	353,498
Used by colliery consumption and workmen	1,068,935	1,129,772	991,317	1,108,449	1,146,229	1,282,710	1,150,315
Production†	13,403,730	12,176,365	11,845,556	12,931,603	12,541,749	13,373,148	12,215,373
Stock on hand Jan. 1	344,156	290,424	241,517	118,062	75,305	92,038	—
Stock on hand Dec. 31	446,854	216,207	152,862	70,270	68,376	91,670	—
Difference	+ 102,698	— 74,217	— 88,655	— 47,792	— 6,929	— 368	— 30,837
Loss due to washing, breakage, or other causes	362,213	387,801	278,988	344,495	353,895	431,135	387,477
Total output	13,868,641	12,489,949	12,035,889	13,228,306	12,888,715	13,803,915	12,572,013

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* Also stated as "Used by producers in making coke, steel, brick, &c."

† Production is obtained by adding coal sold and coal used.

Consumption of Coal in Canada.

	Quantity (long tons).						
—	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Production	13,403,730	12,176,365	11,845,556	12,931,603	12,541,749	13,373,148	12,215,373
Exports of Canadian coal	1,394,661	1,270,648	1,577,270	1,906,571	1,547,461	1,622,495	1,848,259
Home consumption of Canadian coal	12,009,069	10,905,717	10,268,286	11,025,032	10,994,288	11,750,653	10,367,114
Imports	16,251,744	13,143,801	11,130,270	15,696,967	18,622,732	19,355,881	15,454,319
Exports, foreign coal	62,112	74,230	53,295	56,056	42,257	60,255	50,882
Canadian consumption of imported coal	16,189,632	13,069,571	11,076,975	15,640,911	18,580,475	19,295,626	15,403,437
Total consumption of coal in Canada	28,198,701	23,975,288	21,345,261	26,665,943	29,574,763	31,046,279	25,770,551

Exports of Coal from Canada (Domestic Produce).

Fiscal years ending March 31.

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom	35,451	16,562	25,592	54,533	109,788	131,036	131,305
Newfoundland	149,733	196,568	151,393	230,873	212,054	204,161	243,950
Australia ...	18,686	23,327	29,321	27,864	9,680	16,230	16,525
Other British Possessions	19,183	10,314	4,660	20,810	40,364	20,410	12,236
Total to British Possessions	223,053	246,771	210,966	334,080	371,886	371,837	404,016
United States	1,455,775	1,041,882	1,061,816	1,304,091	1,163,504	1,153,021	1,072,674
Alaska ...	59,664	21,476	46,763	56,737	67,849	65,871	34,715
Argentina ...	19,854	4,769	1,026	—	—	—	—
Other Foreign Countries	77,362	23,334	29,864	65,024	92,462	107,494	119,523
Total to Foreign Countries	1,612,655	1,091,461	1,139,469	1,425,852	1,323,815	1,326,386	1,226,912
TOTAL ...	1,836,708	1,338,232	1,350,435	1,759,932	1,695,701	1,698,223	1,630,928
	Value (£.) *						
United Kingdom	25,064	12,834	20,174	43,926	135,465	195,393	222,791
Newfoundland	102,223	134,998	106,450	161,659	188,662	227,876	326,115
Australia ...	15,260	19,165	26,107	24,111	9,053	17,200	24,325
Other British Possessions	16,312	8,574	3,299	18,683	51,032	41,896	27,287
Total to British Possessions	158,859	175,571	156,030	248,379	384,212	482,365	600,518
United States	860,507	552,751	700,185	895,216	870,026	1,099,327	1,273,944
Alaska ...	67,439	21,330	50,673	61,493	72,279	80,950	55,079
Argentina ...	13,815	3,895	718	—	—	—	—
Other Foreign Countries	56,693	18,071	22,864	51,738	93,698	146,532	189,151
Total to Foreign Countries	998,454	596,047	774,440	1,008,447	1,036,003	1,326,809	1,518,174
TOTAL ...	1,157,313	771,618	930,470	1,256,826	1,420,215	1,809,174	2,118,692

* Values converted to £ sterling at the rate of 1 dollar = 4*s.* 2*d.*

Exports of Coal from Canada. (Foreign Produce.)

Fiscal years ending March 31.

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	—	—	13	6,751	—	—	—
Newfoundland ...	355	497	421	481	501	59	159
British West Indies...	—	—	18	—	—	—	—
Total to British Possessions	355	497	452	7,232	501	59	159
Belgium	—	18	—	—	—	—	—
France	—	20	—	—	9,369	—	—
Greenland, Iceland, &c.	—	—	—	—	—	—	5
St. Pierre and Miquelon	2	—	—	—	—	58	2
United States ...	54,388	47,852	78,693	48,463	39,055	43,669	62,070
Alaska	—	—	—	—	38	19	—
Total to Foreign Countries	54,390	47,890	78,693	48,463	48,462	43,746	62,077
TOTAL ...	54,745	48,387	79,145	55,695	48,963	43,805	62,236
	Value (£).*						
United Kingdom ...	—	—	22	11,047	—	—	—
Newfoundland ...	651	840	751	846	1,104	182	670
British West Indies...	—	—	37	—	—	—	—
Total to British Possessions	651	840	810	11,893	1,104	182	670
Belgium	—	42	—	—	—	—	—
France	—	21	—	—	2,826	—	—
Greenland, Iceland, &c.	—	—	—	—	—	—	16
St. Pierre and Miquelon	4	—	—	—	—	184	6
United States ...	20,345	18,080	34,432	15,769	15,338	37,021	43,155
Alaska	—	—	—	—	62	39	—
Total to Foreign Countries	20,349	18,143	34,432	15,769	18,226	37,244	43,177
TOTAL ...	21,000	18,983	35,242	27,662	19,330	37,426	43,847

* Values converted to £ sterling at the rate of 1 dollar = 4*s.* 2*d.*

Imports of Anthracite and Anthracite Dust into Canada.

Fiscal years ending March 31.

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	25,607	30,276	24,209	2,553	937	2,929	99
Newfoundland ...	—	—	22	—	—	—	—
Total from British Possessions	25,607	30,276	24,231	2,553	937	2,929	99
United States ...	3,757,706	3,885,565	3,889,525	3,952,035	4,081,599	4,690,191	4,243,462
China	—	51	—	4	—	—	—
Total from Foreign Countries	3,757,706	3,885,616	3,889,525	3,952,039	4,081,599	4,690,191	4,243,462
TOTAL ...	3,783,313	3,915,892	3,913,756	3,954,592	4,082,536	4,693,120	4,243,561
	Value (£).*						
United Kingdom ...	25,768	31,152	27,023	3,058	1,792	5,333	198
Newfoundland ...	—	—	36	—	—	—	—
Total from British Possessions	25,768	31,152	27,059	3,058	1,792	5,333	198
United States ...	4,224,082	4,288,375	4,332,845	4,259,557	4,749,490	5,837,839	5,456,427
China	—	83	—	4	—	—	—
Total from Foreign Countries	4,224,082	4,288,458	4,332,845	4,259,561	4,749,490	5,837,839	5,456,427
TOTAL ...	4,249,850	4,319,610	4,359,904	4,262,619	4,751,282	5,843,172	5,456,625

* Values converted to £ sterling at the rate of 1 dollar = 4*s.* 2*d.*

Imports of Coal into Canada (bituminous round and run-of-mine, and coal not otherwise specified).

Fiscal years ending March 31.

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	5,655	1,496	10,055	1,236	1,038	1,780	259
Australia	—	11.991	—	3	—	—	—
Total from British Possessions	5,655	13,487	10,055	1,239	1,038	1,780	259
Alaska	—	—	65	—	—	—	—
St. Pierre and Miqnelon	14	—	—	—	—	—	—
United States ...	8,021,142	9,641,313	6,097,897	6,204,946	8,603,019	11,831,515	12,077,189
Japan	5	4,349	—	—	—	—	—
Total from Foreign Countries	8,021,161	9,645,662	6,097,962	6,204,946	8,603,019	11,831,515	12,077,189
TOTAL ...	8,026,816	9,659,149	6,108,017	6,206,185	8,604,057	11,833,295	12,077,448
	Value (£).*						
United Kingdom ...	3,738	1,227	7,965	1,294	1,067	933	257
Australia	—	10,744	—	3	—	—	—
Total from British Possessions	3,738	11,971	7,965	1,297	1,067	933	257
Alaska	—	—	41	—	—	—	—
St. Pierre and Miquelon	16	—	—	—	—	—	—
United States ...	3,678,163	4,535,031	2,683,908	1,647,526	3,135,167	7,737,145	7,655,808
Japan	5	3,150	—	—	—	—	—
Total from Foreign Countries	3,678,184	4,538,181	2,683,949	1,647,526	3,135,167	7,737,145	7,655,808
TOTAL ...	3,681,922	4,550,152	2,691,914	1,648,823	3,136,234	7,738,078	7,656,065

* Values converted to £ sterling at the rate of 1 dollar = 4*s.* 2*d.*

Imports of Bituminous Slack, such as will pass through a ¾ inch Screen, into Canada.

Fiscal years ending March 31.

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	4,420	1,528	—	1,179	475	6,082	202
United States ...	1,844,574	2,619,898	2,038,857	2,391,833	2,941,071	2,803,480	2,716,122
Japan	3	—	—	—	—	—	—
Total from Foreign Countries	1,844,577	2,619,898	2,038,857	2,391,833	2,941,071	2,803,480	2,716,122
TOTAL	1,848,997	2,621,426	2,038.857	2,393,012	2,941,546	2,809,562	2,716,324
	Value (£).*						
United Kingdom ...	3,016	820	—	399	180	1,915	69
United States ...	574,974	895,002	669,737	479,779	878,225	1,901,198	1,596,201
Japan	2	—	—	—	—	—	—
Total from Foreign Countries	574,976	895,002	669,737	479,779	878,225	1,901,198	1,596,201
TOTAL	577,992	895,822	669,737	480,178	878,405	1,903,113	1,596,270

* Values converted to £ sterling at the rate of 1 dollar = 4*s*. 2*d*.

Sales of Coke in Canada.

Year.	Nova Scotia.		Ontario.		Alberta.		British Columbia.		Total.	
	(long tons.)	(£)*	(long tons.)	(£)*	(long tons.)	(£)*	(long tons.)	(£)*	(long tons.)	(£)*
1913 ...	644,677	490,032	374,363	414,919	60,181	56,169	287,296	272,129	1,366,517	1,233,249
1914 ...	306,508	233,045	344,923	281,687	25,946	24,216	236,784	223,242	914,161	762,190
1915 ...	523,101	397,035	254,688	237,709	21,273	19,855	246,003	232,605	1,045,065	887,204
1916 ...	584,315	545,361	421,881	418,366	37,455	34,958	268,618	261,609	1,312.269	1,260,294
1917 ...	574,783	670,580	347,364	449,026	28,258	37.913	161,972	230,519	1,112,377	1,388,038
1918 ...	518,244	1,243,044	379,542	687,526	29,155	44,559	189,795	323,870	1,116,736	2,298,999
1919 ...	342,190	820,814	579,916	1,018,055	504	750	89,604	185,462	1,012,214	2,025,081

* Values converted to £ sterling at the rate of 1 dollar = 4*s*. 2*d*.

Canadian Imports and Exports of Coke.

Year.	Imports.		Exports.	
	Quantity (long tons).	Value* (£.)	Quantity (long tons).	Value* (£.)
1913	646,345	454,340	60,924	64,252
1914	493,791	330,262	60,570	63,774
1915	569,515	335,097	32,026	33,344
1916	675,996	464,391	43,338	46,111
1917	866,166	1,357,762	21,067	28,608
1918	1,040,705	1,869,884	26,439	46,589
1919	342,298	501,196	13,133	27,040

* Values converted to £ sterling at the rate of 1 dollar = 4*s.* 2*d.*

Output of Tar and Sulphate of Ammonia in Canada.

Year.	Tar. Quantity (Imp. galls.).	Sulphate of Ammonia. Quantity (long tons).
1913	8,371,600	9,471
1914	5,714,172	7,654
1915	7,365,931	9,329
1916	9,012,202	9,857
1917	8,277,078	8,876
1918	8,009,327	9,665
1919	12,394,249	10,504

Nova Scotia.

In the province of Nova Scotia there are several large areas of bituminous coal, most of which are being actively worked.

The Nova Scotia fields, besides supplying the requirements of that province, send their coal to the provinces of Quebec and Ontario, the eastern part of the United States, New Brunswick, Newfoundland, Prince Edward Island, and the West Indies: the relative quantity shipped to each being about in the following order:—

1. From Sydney coalfield.
2. ,, Inverness ,,
3. ,, Richmond ,,
4. ,, Pictou ,,

The Sydney coalfield is situate in the north-east corner of Cape Breton county, with the magnificent deep water harbour of Sydney as its central feature : it also takes in a small portion of Victoria county.

During the few months of winter, when the more northerly harbours are closed or obstructed by ice, an outlet for the coal is afforded by the railway connecting many of the collieries with Louisburg, a fine harbour, open and safe for shipping at any season. Another outlet is afforded by the Canadian National railway.

The coal mining industry is developed so that there are mines conveniently situated, not only for all parts of the province of Nova Scotia, but, also for Prince Edward Island and New Brunswick; while, in summer, shipments can be made from all the mines, by way of the St. Lawrence river, to the province of Quebec.

The aggregate thickness of coal in the workable beds outcropping on the shore, ranges from 30 feet at some places to 60 feet at others. Most of the Sydney coals are well suited for the manufacture of gas, as the following figures show :—

The suitability of Sydney coals for gas manufacture.

Mines.	Gas per ton of coal.	Candle power.	Coke per ton of coal.
	Cubic Feet.		
Little Glace Bay	9,268	15	40 bushels.
Little Glace Bay	9,700	14·75	39 „
International	10,000	16	1,470 lb.
Sydney	8,200	8	1,295 „
Gowrie	9,000	15	1,230 „
Caledonia	8,900	14·25	36 bushels.
Reserve	9,950	13·17	1,500 lb.

* The Dominion Coal Company are now obtaining ten per cent. of their entire output from the Emery seam which is an almost untouched area of coal. The coal is a good steam-coal, giving a fairly large quantity of light flocculent ash that does not clinker, and, after mechanical washing, produces a good metallurgical coke. The coal is in considerable demand for locomotive use, and for steamship bunkers. The Emery seam is underlaid by the Clarke, Martin and Mullins seams each over 3 feet in thickness, and not yet worked. The remaining 90 per cent. of the output is obtained

from the three upper seams, namely, the Hub, Harbour, and Phalen seams.

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* Canadian Mining Journal (Quebec), Oct. 14, 1919, p. 775.

The production of the larger coal companies in Nova Scotia, during 1918, was as follows, that for the year 1913 being shown for comparison. The year 1913 was that of maximum production, and was the last normal year before the war.

	Quantity (long tons). 1913.	1918.
Dominion Coal Co.—		
Springhill Mines ...	381,434	367,000
Sydney district	4,739,139	3,273,000
Nova Scotia Steel Co. ...	813,877	500,000
Acadia Coal Co.	539,121	280,000
Canadian National Coal Co.	189,550	175,000
Inverness Coal & Rly. Co. ...	293,847	200,000
Maritime Coal & Rly. Co. ...	155,051	180,000
Other Operators	151,466	211,000
Totals	7,263,485	5,186,000

In 1917 and 1918 no coal was sent from Nova Scotia to the Montreal market, United States coal being used there in substitution. The reason was, that no coal was available, on account of the reduced production of Nova Scotia, and that the Admiralty requisitioned the coal-freighters, which the coal companies (particularly the Dominion Coal Co.) held on long-term charters, at cheap rates for hire. Without these vessels, whether production recovered or not, Nova Scotia coal was excluded, by reason of the cost of freight, from competition with United States coal, in the Montreal market.

A significant feature bearing on the future cost of coal-mining in Nova Scotia, is that 65 to 70 per cent. of all the coal now mined comes from submarine areas. In the future, the percentage of submarine extraction will increase, as the great bulk of the coal reserve is under the sea.

The proportion of the coal output of Nova Scotia used in steel manufacture is now so great that the production of coal for domestic use has become of secondary importance.

During the year 1919 much activity was shown by the steel and coal companies of Nova Scotia, and a large scheme of extension was carried out, involving the erection of a new plate mill and coke ovens. During the year over one million dollars was expended on the iron mines and quarries in Newfoundland, whence the steel companies of Nova Scotia obtain their ore, and additions on a large scale were made to the steel-works at Sydney.

COKE.

In 1913, Nova Scotia continued to be the leading province in the manufacture of coke. Coke was made during the year at Sydney, Sydney Mines and Westville, but the ovens at Stellarton and Londonderry were idle. The coke output was used almost entirely in the manufacture of iron and steel. The Dominion Iron and Steel Co. had 620 ovens of the Otto-Hoffman by-product type, and the tar was sold to the Dominion Tar and Chemical Co., whose works adjoin the coke oven plant, who treated it for the manufacture of refined tar, pitch (of various grades), benzol, creosote, carbolic acid and other tar products. The Nova Scotia Steel and Coke Co. had 30 ovens of the Bauer type and 120 Bernard ovens. The other ovens, in Nova Scotia, numbered 178, all of the beehive type.

At the close of 1914, 238 ovens (of which 208 were by-product ovens) were in operation, and 710 were idle.

At the close of 1915, 638 ovens (of which 488 were by-product ovens) were in operation and 168 were idle. The ovens at Stellarton and Londonderry were regarded as being abandoned.

At the close of 1916, 697 ovens were in operation, 547 being of the by-product type.

In 1918 the sales of coke amounted to 518,244 tons, which, compared with 1913, shows a decrease of 126,433 tons.

No quantitative comparison of by-products can be made as the available tables of statistics are based on the total output of the whole Dominion.

*Coal Resources of Nova Scotia.**

District.	Including seams of 1 ft. or over to a depth of 4,000 ft.					Including seams of 2 ft. and over, at depths between 4,000 and 6,000 ft.	
	Actual reserve. (Calculation based on actual thickness and extent.)			Probable reserve. (Approximate estimate.)		Probable reserves. (Approximate estimate.)	
	Area. Sq. miles.	Class of coal.	Tons.	Area. Sq. miles.	Tons.	Area. Sq. miles.	Tons.
Cumberland County	60	Bituminous ...	682,000,000	5	250,000,000		
Colchester	—	" ...	—	1	1,000,000		
Pictou	11	" ...	390,440,000	8	450,000,000		
Antigonish	—	" ...	—	1	20,000,000		
Richmond	—	" ...	—	4	12,360,000		
Inverness :—							
Land area	6	" ...	61,800,000	10	22,000,000		
Submarine area	4	" ...	86,000,000	7	73,000,000		
Cape Breton County :—							
Land area	93	...	1,027,911,000	—	—		
Marine, 3 mile limit	—	" ...	—	168	4,063,457,000		
Marine, 3 to 5 miles	—	" ...	—	—	—	73	2,639,000,000
TOTALS	174		2,248,151,000	204	4,891,817,000	73	2,639,000,000
Less amount mined prior to 1913 ...	...	... ...	60,000,000				
			2,188,151,000				

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* Coal Resources of the World, 1913, Vol. II, p. 443.

New Brunswick.

Minto, near the north point of Grand Lake, on the Canadian Pacific Railway, between Fredericton and Norton, and about 60 miles from the latter, is the centre of the coal industry in New Brunswick. A certain proportion of the coal is hauled to the shore of Grand Lake, whence it is shipped by water to St. John. The annual production of coal in New Brunswick increased from 8,136 tons in 1904 to 168,835 tons in 1917, an increase largely brought about by the adoption of working by stripping-off the surface rock and soil. The coal, when properly mined and handled, furnishes a fuel for steam-raising and house purposes equal to that produced by most of the mines of Nova Scotia, and yields a fair profit to the operator. Before the war, the price of screened coal, delivered to the Intercolonial railway, at Norton Station, was 14*s*. per ton.

Ontario.

In Ontario there are extensive areas of low-grade lignites in the district of the Moose River Basin, but transport facilities are lacking.

Ontario is almost entirely dependent for coal on the United States, as Nova Scotia coal is not sent farther west than Cornwall. Some of the mine operators of Nova Scotia believe that, if the Ottawa and Georgian Bay Canal were constructed and the St. Lawrence canals were enlarged, they could supply coal at all ports of Ontario bordering on the Great Lakes. Coal can be carried much more economically in large ships than in small ones, and the coal boats sailing from Nova Scotia to Montreal are too large to pass through the St. Lawrence canals, while the cost of transhipment at Cornwall to smaller boats for Montreal is too great in competition with United States coal, which is mined in closer proximity to Ontario.

COKE.

In 1913, Ontario occupied the second place in the Dominion in the manufacture of coke, the production being from 104 Koppers by-product regenerative ovens belonging to the Algoma Steel Corporation, Ltd., at Sault Ste. Marie.

The sales in 1913 amounted to 374,363 tons, valued at £414,919. In 1918, they amounted to 379,542 tons, valued at £687,526, showing an increase of 5,179 tons and £272,607, respectively, compared with 1913.

Alberta, Saskatchewan, Manitoba and British Columbia.

The coal areas of Alberta were formerly divided into four districts, viz., Crowsnest Pass (Blairmore-Frank Field), Lethbridge, Calgary and Edmonton. In 1916, 34 separate districts were formed in order that more detailed information might be obtained by the Mines Branch of the Department of Public Works for the provinces.

About one-half of the coal production of Alberta, and the whole of that of Saskatchewan, consists of lignite. The Alberta lignite is of Cretaceous age, and is obtained from the Edmonton beds. In Saskatchewan, lignite occurs in two horizons; the higher is probably of Tertiary age, and the lower forms the Belly River division of the Cretaceous period.

The coal output of Alberta and Saskatchewan is mainly used in these provinces and in Manitoba; a certain proportion, however, of the Blairmore-Frank coalfield production is converted into coke and shipped to the smelting centres of British Columbia and to the United States. The railways also use a large quantity of the bituminous coal in western Alberta.

In Manitoba, and the north-west provinces, there are very large tracts of prairie land underlain by coal measures, the character of the deposits varying from lignite in the east to bituminous coal in the west. In the Cascade coalfield, Alberta, at Bankhead, three miles north of Banff, there is a small basin where anthracite is mined. Across the watershed of the Rocky Mountains, in British Columbia, the Crowsnest Pass coalfield is a very large producer.

Alberta.

* The output of coal from this province, during the eight years prior to 1913, increased approximately by 300 per cent. The production of coal in 1913 amounted to 3,584,603 tons, valued at £2,170,613, the average price per ton being 12*s.* 1*d.* This showed a substantial advance of over 2 million tons, compared with the previous year.

During 1913, a considerable quantity of coal was worked in the neighbourhood of Edmonton by means of "stripping," the process consisting in removing the surface clay by means of a steam shovel, after which the coal is quarried and loaded direct into the railway cars. A railway was constructed early in 1914 to the mines of the Brazeau Collieries, Ltd., at Red Deer, between Edmonton and Calgary, opening out another large steam coal area.

In 1915, there was a decrease in the production of coal of 287,676 tons compared with the previous year, due to the poor condition of trade throughout the country and also to the reduction in the demand for domestic coal, owing to the extremely mild weather in the early part of the year. There was, however, an increase in the production of lignite from the Calgary district, through further development in the Drumheller district. The strike which took place in Southern Alberta during 1911 was responsible for the strong position which the United States coals obtained in the Winnipeg market, which, however, was being largely recovered. Owing to the large number of men recruited from the mining districts, 1,623 fewer were employed in 1915 than in 1913, when the number was 8,068.

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* Repts. of the Mines Branch Alberta. (Annual.)

In 1916, there was an increase in production of 1,069,854 tons, compared with the previous year, the output amounting to 4,070,584 tons, establishing a record output for the province. There was an increase of 1,325 in the number of men employed, compared with the previous year. During the year, a larger amount of coal was sent into Saskatchewan and Manitoba, but, notwithstanding the increased output, 2,598,729 tons of coal were imported into the territory lying between Port Arthur and the western boundary of Alberta.

In 1917, there was also a slight increase of production of 158,316 tons, despite the serious loss in output, caused by strikes, and by the lack of railway facilities in certain districts.

In 1918, the coal production amounted to 5,332,871 tons, valued at £4,278,601, or an average value of 16*s*. 0*d*. per ton, and included 103,040 tons of anthracite from one mine at Bankhead. This was the first year when Alberta ranked as the largest coal-producing province in Canada, producing over 40 per cent. of the whole output of the Dominion. Compared with 1913, there was an increase of production of 1,748,268 tons, and an increased value of £2,107,988; the average value per ton, in 1918, being 16*s*. 1*d*.

The number of persons employed in mines in December was 10,209, compared with 8,068 in 1913. Although there was an increased production in 1918, the operations of the mines were limited at the end of the year to about 60 per cent. of their capacity, owing to lack of market. During the last three months of the year, a number of mines—particularly in northern Alberta—were working, on an average, only about two days per week.

The large increase in the quantity of Alberta coal used as domestic fuel in Manitoba, especially noticeable since 1918, was caused chiefly by a statement, made by the Fuel Controller of Canada, that consignments of anthracite from the United States to Canada would be reduced very considerably during 1918, and, also, by an extensive publicity campaign which was started by the Provincial Government of Alberta, warning consumers to obtain their supply of fuel at the earliest opportunity.

In the Annual Report for 1918 of the Mines Branch of the province of Alberta, J. T. Stirling, Chief Inspector of Mines, who was appointed Fuel Administrator by the Provincial

Government to assist the Fuel Controller for the Dominion of Canada, made the following statement:—

> "Although the amount of coal produced during 1918 was considerably in excess of that produced during 1917, this amount only represents, approximately, 50 per cent. of the possible production in the province, with the present development; and, if anything is to be done to obtain the Manitoba market by a decreased cost of production, the first thing to consider is the question of regulating the production in such a way that the coal mines in operation should produce at least 80 per cent. of what they are capable of doing. It is also important that only the best grades of coal which we can produce in the province are shipped into the markets where Alberta coal has to compete with imported coal, and this can only be done by instituting a system of zoning, such as has been done in the United States during the last two years. The procedure would, of course, be harmful to the mines producing low grades of fuel, inasmuch as their market would be restricted, but it would undoubtedly be to the benefit of the province as a whole."

During 1918, the pay roll at mines, for labour alone, was approximately, £2,916,667, so that the importance of the mining industry in the province will readily be seen.

According to figures supplied by the Federal Government, there is a market available for Alberta coal of, approximately, nine million tons per year; and at least fifty per cent. of this market can be obtained, if all the coal is properly prepared, and if the best quality only is sold in the territory into which United States coal is shipped.

* About three million tons of imported coal are consumed in the provinces of Manitoba, Saskatchewan and Alberta, a territory which, it is considered, should be entirely supplied by Alberta mines.

COKE.

The only coke ovens in operation in Alberta during the year 1913 were those of the beehive type, at Coleman, and the production amounted to 60,181 tons, valued at £56,169. A small quantity of coke is exported from this province, but the export trade is chiefly, and often solely, confined to British Columbia.

In 1914, the production decreased to 25,946 tons, none of which was exported during that year.

In 1918, the production was 29,155 tons valued at £44,559 which, compared with 1913, shows a decrease of 31,026 tons and £11,610 respectively.

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* Annual Report of the Dept. of Public Works, 1917, p. 74.

*The Coal Resources of Alberta.**

Including Seams of 1 foot or over, to a depth of 4,000 feet.

District.	Actual Reserve. (Calculation based on actual thickness and extent.)			Probable Reserve. (Approximate estimate.)	
	Area in sq. miles.	Class of Coal.	Tons.	Area in sq. miles.	Tons.
Tertiary beds	—	Lignite	—	2,520	23,721,000,000
Edmonton and lower Paskapoo beds, top seams.	15,645	Lignite	272,600,000,000	6,830	149,100,000,000
Edmonton beds, Edmonton seams.	9,590	Lignite and Bituminous	111,097,000,000	20,340	268,161,000,000
Belly River beds ...	—	Bituminous and Lignite	—	25,974	189,450,000,000
Kootenay measures ...	65	Anthracitic and Bituminous	2,695,800,000	711	43,122,600,000
	25,300		386,392,800,000	56,375	673,554,600,000
Arranged in the following classes of coal.		Lignite Bituminous Anthracitic	382,500,000,000 3,223,800,000 669,000,000		491,271,000,000 182,183,600,000 100,000,000
			386,392 800,000		673,554,600,000
Less coal mined to 1911	...	... ...	20,000,000		
			386,372,800,000		
Seams of 2 ft. or over, between depths of 4,000 and 6,000 feet.	—	Bituminous	—	203	12,700,000,000

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* Coal Resources of the World, 1913, Vol. II, p. 475.

Coal-Cutting Machinery in use in Alberta.

Year.	Coal-cutting machines operated by :—		Coal mined by :—	
	Electricity.	Compressed air.	Electricity.	Compressed air.
			long tons.	long tons.
1913... ...	4	163	107,920	757,572
1914... ...				
1915... ...				
1916... ...	8	160	179,104	793,865
1917... ...	14	165	239,362	857,497
1918... ...	24	193	483,375	1,186,130
1919... ...				

Production of Patent Fuel in Alberta.

Year.	Quantity (long tons).
1913	80,357
1914	116,840
1915	97,393
1916	74,268
1917	96,392
1918	83,766
1919	89,705

Saskatchewan.

Lignite only is mined in this province. The output is obtained, chiefly, from the vicinity of Estevan, on the Souris river, near the south-eastern corner of the province.

The total production of lignite, in 1913, as reported by 29 separate collieries, was 190,086 tons, valued at £74,623, the average value per ton being 7*s*. 10*d*.

In 1914, there was an increased production of 9·11 per cent., compared with the previous year.

The production in 1918, from 67 collieries, amounted to 309,685 tons, valued at £150,447, being an increase, compared with 1913, of 119,599 tons and £75,824 respectively; the average value per ton in 1918 was 9*s*. 6*d*. per ton.

*The Coal Resources of Saskatchewan.**

Including Seams of 1 foot or over, to a depth of 4,000 feet.

District.	Coal Seams.		Actual Reserve. (Calculation based on actual thickness and extent.)			Probable Reserve. (Approximate estimate.)	
	No.	Thickness.	Area in Square Miles.	Class of Coal.	Tons.	Area in Square Miles.	Tons.
Belly River Coal	1	Maximum 8 ft.	18	Lignite	108,000,000	1,500	11,000,000,000
	2	4 ft. & 7 ft. ...	—	Do.	—	5,700	22,800,000,000
Tertiary Coal		Maximum 18 ft.	288	Do.	2,304,000,000	5,900	23,600,000,000
TOTALS ...			306		2,412,000,000	13,100	57,400,000,000

* Coal Resources of the World, 1913, Vol. II., p. 473.

British Columbia.*

The Crowsnest Pass coalfield is situated immediately west of the summit of the Rocky Mountains in Crowsnest Pass. The Crowsnest branch of the Canadian Pacific Railway crosses the northern part of the coalfield, and skirts its western edge for a distance of 25 miles, providing the means of fuel transportation to the great smelting centres of British Columbia. The Great Northern Railway, also, serves as an outlet.

Before the opening-up of this field, the smelting industries of the Kootenays, and of Washington in the United States, depended in a great measure on coke from the coast coal mines, and the transportation charges, added to a comparative high initial cost, rendered it very expensive. The cost of fuel to the smelters has since been reduced to about one-half.

In this field, three large companies are working extensively one to five seams of coal, aggregating 40 to 48 feet in thickness. One of these, the Crowsnest Pass Coal Co., Ltd., is the largest coal producer in western Canada—the yearly output in Canada as a whole being exceeded only by the Dominion Coal Co. in Nova Scotia.

The Nicola Valley coalfield, in the Kamloops district, although not so extensive as either the Crowsnest or the Vancouver

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* Repts. of the Minister of Mines, British Columbia (Annual). Repts. on Mineral Production of Canada (Annual).

Island fields, is of great economic importance, and is manifestly destined to find a market in a considerable part of central British Columbia. This coalfield has an area of approximately 40 square miles, and a partial section of the measures, from Coal Gulley to the Coldwater river, gives six seams with an aggregate of 54 ft. 6 in. of coal in a thickness of 1,268 feet of the measures.

The Vancouver Island fields now being exploited are situated on the east coast of the island, in the vicinity of Nanaimo and Comox. Two companies are actively working in this field, in the vicinity of Coutlee.

Deposits of anthracite coal occur at Groundhog Mountain, British Columbia, on the head waters of the Skeena, Nass, and Stikine rivers. The shape of the field approximates to a parallelogram, with an area of about 900 square miles. Over large districts the coal seams have been completely or partly removed by erosion. The nearest boundary of the parallelogram lies about 80 miles north-east of Stewart, at the head of the Portland canal, and 110 miles a little west of north from Hazelton.

In consequence of various reports as to the existence of a very extensive coalfield in this district, and of the importance of such a coalfield to the development of the province, the Provincial Mineralogist (Mr. William Fleet Robertson) was instructed by the Minister of Mines to visit the field during the summer of 1912, and to report upon the results actually obtained by development. Up to that time, all access to the Groundhog coalfield was from Hazelton, following the "Telegraph Trail," to between the 5th and 6th Cabin, then following the old Ashcroft trail, used in the '70's, up Slowmaldo creek to its source and over Groundhog Mountain, at an altitude of 5,700 feet, dropping again to the valley of the Skeena at an altitude of 3,000 feet. The contract rate for packing over this trail at that time was 20 cents (10*d.*) a pound, but owing to the character and condition of the trail the packers did not make a profit, even at that rate. Referring, in 1914, to the Groundhog coalfield, Mr. J. D. Galloway, Assistant Provincial Mineralogist, stated that "the development of this field will never be possible until a railway of somewhere about 150 miles in length is built connecting it either with the Grand Trunk Pacific or to some point on the Coast."

These anthracitic coal beds are said to be of the same age as the bituminous beds of the Crowsnest Pass coalfield.

The seams vary in thickness from 3 ft. to 8 ft. The coal, so far as developed, contains, in the majority of cases, a high percentage of ash.

Referring to his visit to the Groundhog coalfield in 1912, mentioned above, the Provincial Mineralogist says : "The extent of the coalfield proved to be all that was claimed, but the quality of the seams as exposed in the openings seen in the southern end of the field was very disappointing. The field has only been tested in one part, and it seems quite probable that further prospecting will develop cleaner seams of coal; the number and thickness of the seams is all that could be desired."

The Annual Report of the Minister of Mines for British Columbia, for the year 1912, contains an extract from a paper read before the Canadian Mining Institute, in March, 1912, by Mr. G. W. Evans, of Seattle, one of the two coal-mining engineers engaged by the B.C. Anthracite Coal Mining Company, in which he speaks of the field as containing some "excellent coal; in fact, so far as I have seen, the best domestic coal to be found on the coast;" and he gives some analyses, as follows:—

Analyses of Groundhog Coals.

Proximate Analysis.				Sulphur.	Calorific Value.
Moisture.	Fixed Carbon.	Volatile Hydrocarbons.	Ash.		
Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	B. Th. U.
4·42	58·96	6·58	30·04	1·61	9,930
4·01	57·71	13·08	25·20	2·42	9,600
2·71	67·42	6·09	23·78	3·05	12,650
2·97	65·60	5·59	25·84	1·90	11,520
2·45	63·96	3·86	29·73	1·93	10,280
3·55	70·68	4·02	21·75	0·99	11,980
3·75	65·13	5·74	34·36	1·57	9,600
4·50	47·73	6·25	41·52	0·99	7,800
3·77	57·75	4·27	34·21	0·60	9,580
5·95	46·67	13·32	34·06	0·44	9,360
3·20	49·43	7·02	40·35	0·99	7,860
1·17	76·20	6·05	16·58	0·72	12,215
1·04	67·89	9·39	22·68		
1·17	83·37	6·54	8·92	0·74	13,238
2·39	78·54	7·90	10·18	0·99	
4·12	82·60	7·43	5·85	0·46	
5·95	82·00	8·00	4·05	0·49	
2·62	84·49	6·96	5·93	5·75	13,814
5·75	75·26	7·34	11·65		
4·45	79·25	8·75	7·55		
1·40	70·68	6·06	21·86	1·60	11,788

In 1913, the continuation of the labour troubles at the mines on Vancouver Island was responsible for a falling off in the production of British Columbia, that of the previous year being one of the largest obtained in this province. The strike of coal miners, which had been in operation for about two years, was brought to a close during 1914, when the miners' organisation discontinued the payment of strike benefits.

Of the total quantity of coal raised in British Columbia in 1913, about 45 per cent. was sold for consumption in Canada, 24 per cent. was sold for export to the United States, 17 per cent. was used in making coke, 7 per cent. was lost in washing, and 7 per cent. was used under colliery boilers, etc., and by workmen.

According to the Annual Reports on the Mineral Production of Canada, there was a decrease of 423,769 tons in the production for 1914, compared with 1913, mainly attributable to the reduced output of the metalliferous mines and smelting plants brought about by the war, thus diminishing the amount of railway traffic, which constitutes the chief market for the coal. For a period of four or five months, enemy cruisers interfered with the steamship trade, to which Vancouver Island collieries ordinarily look for a considerable portion of their market. The collieries of the Coast District, including the Nicola Valley field, produced about 56 per cent. of the total output of the province.

One of the principal events of 1914 was the closing down of the large mine at Hosmer in the Crowsnest coalfield, owned by the Canadian Pacific Railway Company, after about £200,000 had been spent on the undertaking with unsatisfactory results.

In 1915, there was another fall in the production compared with the previous year, amounting to 155,524 tons, consequent upon the reduced consumption of coal in the province. The market for the Coast collieries was seriously affected by the diminished sales of bunker coal to ocean steamers.

In 1916, there was an increase of 462,899 tons in the production, compared with the previous year. This would have been much greater, but for a series of misfortunes at the Crowsnest collieries, and a considerable shortage of labour, partly caused by the heavy enlistment of the younger men.

In 1917, there was a decrease of 134,083 tons, compared with the previous year.

In 1918, the total production for British Columbia amounted to 2,293,383 tons, valued at £2,394,725, giving an average price of £1 0*s*. 10*d*. per ton. This shows a decrease in quantity of 130,206 tons, but with an increase in value of £627,525 (or of 6*s*. 3*d*. per ton), as compared with 1913.

COKE.

The coal produced in the western provinces of the Dominion is used chiefly by the copper and lead smelters, and finds a market in the United States as well as in Canada. None of the ovens in operation is of the by-product type, and the principal producers are the Crowsnest Pass Coal Co., with 454 beehive ovens at Fernie and 486 at Michel, and the Canadian collieries (Dunsmuir), with 150 ovens at Comox, on Vancouver Island.

In 1914, the coke trade of British Columbia was adversely affected, though not to the same extent as that of Alberta and Nova Scotia, and only 436 out of 930 ovens at Fernie and at

Michel were in operation at the end of the year. In 1915, the whole of these ovens, with the exception of 123, were in operation, together with 100 additional ovens rebuilt at Union Bay on Vancouver Island. The briskness of trade continued over 1916, and there was a record production for that year of 268,617 tons.

The high market price of copper kept the copper smelting plants of the interior very busy, with, consequently, an increased demand for coke; while, on the coast, the copper smelting plant of the Granby Company at Anyox caused the re-starting of the coke ovens at Comox.

In 1917, the production fell to 161,971 tons, or a decrease of 40 per cent., compared with the previous year. It increased, however, in 1918 to 189,795 tons, valued at £323,870. These figures, when compared with those of 1913, show a decrease in quantity of 34 per cent., but an increase in the value of 19 per cent.

*Coal Resources of British Columbia.**

Including seams of 1ft. or over to a depth of 4,000 ft.

District.	Actual reserve.			Probable reserve.	
	Area.	Class of coal.	Quantity.	Area.	Quantity.
	Sq. miles.		Tons.	Sq. miles.	Tons.
Southern Interior ...	230	Bituminous	22,586,342,000	216	34,587,000,000
		Lignitic ...	—		286,000,000
Central Interior ...	—	Bituminous	—	26	486,700,000
Northern Interior ...	—	Anthracitic	—	5,114	1,200,000,000
	—	Bituminous	—		3,150,000,000
	—	Lignitic ...	—		3,850,000,000
Vancouver Island ...	185	Bituminous	1,178,000,000	645	5,191,000,000
Queen Charlotte Island	22	Anthracitic and bituminous	6,900,000	59	293,000,000
	2	Lignitic ...	60,000,000	136	1,000,000,000
TOTALS ...	...		23,831,242,000	...	50,043,700,000

Approximately, the grades of coal represented in the actual and probable reserves of British Columbia may be arranged as follows:—

	Tons.
Anthracitic	1,349,950,000
Bituminous	69,488,992,000†
Lignitic...	5,196,000,000
Total	76,034,942,000†

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* Coal Resources of the World, 1913, Vol. II, p. 492.

† Including probable reserves at depths between 4,000 and 6,000 ft. of 2,160,000,000 tons, in an area of 11 sq. miles in southern British Columbia.

*Details of the Coal Resources of the Interior of Southern British Columbia.**

Including seams of 1 foot or over, to a depth of 4,000 feet.

District.	Coal-Seams.		Actual Reserve. (Calculation based on actual thickness and extent.)			Probable Reserve. (Approximate estimate.)	
	No.	Thickness.	Area. Sq. miles.	Class of Coal.	Tons.	Area. Sq. miles.	Tons.
Flathead River	7	Aggregate 130 ft. ...	—	Bituminous ...	—	6	600,000,000
Crowsnest	23	" 172 " ...	230	" ...	22,586,342,000	—	16,250,000,000
Do.	24	" 40 " ...	—	" ...	—	—	4,500,000,000
Upper Elk River :—							
North Michel Creek	12	" 80 " ...	—	" ...	—	3	46,000,000
Forks, North Michel Creek ...	1	" 6 " ...	—	" ...	—	1	6,000,000
To McInnis Mountain	8	63 " ...	—	" ...	—	4	120,000,000
To Lewis River	10	80 " ...	—	" ...	—	47	3,692,000,000
Green Hills	10	" 97 " ...	—	" ...	—	60	5,900,000,000
Mount Marpole	18	" 182 " ...		" ...	—		
Aldridge Creek, North	21	" 150 " ...	—	" ...	—	19	3,177,000,000
Bull River (not explored)	—	—	Small Tertiary Outlier.				
Midway	—	—	Several small Tertiary Outliers.				
Okanagan	—	—	"	"			
Princeton :—							
Princeton	3	" 29½ ft. ...	—	Lignite ...	—	1	132,000,000
Tulameen River	1	" 4 ft. ...	—	" ...	—	1	
Sharp's	17	" 50½ ft. ...	—	...	—	1	
Ninemile Creek	1	" 15 ft. ...	—	" ...	—	2	
Summers Creek	1	" 4 " ...	—	" ...	—	1	
Blakemore's bore	3	" 12 " ...	—	" ...	—	1	
General Area	1	" 2 " ...	—	" ...	—	44	86,000,000

Tulameen	3	Aggregate 16½ ft. to 26 ft.	—	Bituminous ...	—	5	98,000,000
Nicola :—							
Coldwater	4	„ 33 ft. ...	—	„ ...	—	1	175,000,000
Merritt	2	„ 9 „ ...	—	„ ...	—	10	
Tenmile River	1	„ 4 „ ...	—	„ ...	—	14	
Quilchena	10	„ 18 „ ...	—	„ ...	—	2	20,000,000
Fraser River delta (unexplored) ...	—	—	—	—	—	—	—
Kamloops (unprospected)	—	—	—	—	—	—	—
Hat Creek	1	„ 68 „ ...	—	Lignite ...	—	2	68,000,000
North Thompson	3	„ 3 ft. 10 in. ...	—	Bituminous ...	—	1	3,000,000
Total	...	... ...	...	...	22,586,342,000	...	34,873,000,000

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* Coal Resources of the World, 1913, Vol. II, pp. 500-502.

Summary.

		Tons.
Bituminous ...	Actual reserve	22,586,342,000
	Probable reserve... ...	34,587,000,000
Lignite ...	Probable reserve... ...	286,000,000
	Total	57,459,342,000

Output, etc. of Coal in British Columbia.

Year.	Quantity (long tons).				Value (£).*
	Output.	Home Consumption.	Sold for Export.	Production.†	
1913 ...	2,587,357	1,799,643	623,946	2,423,589	1,767,200
1914 ...	2,182,164	1,397,036	602,784	1,999,820	1,458,203
1915 ...	1,962,817	1,191,220	653,078	1,844,298	1,344,800
1916 ...	2,487,012	1,463,152	844,045	2,307,197	1,682,331
1917 ...	2,375,745	1,380,325	792,789	2,173,114	1,715,774
1918 ...	2,570,624	1,482,300	811,083	2,293,383	2,394,725
1919 ...	2,417,820	1,413,597	761,343	2,174.940	2,587,593

Details of Coal-cutting machines in use in British Columbia.

——	1915.	1916.	1917.	1918.	1919.
Types of machines used :—					
"Percussive" Post	19	17	11	16	15
"Bar" Longwall	3	5	5	5	3
"Chain" Shortwall	3	5	5	5	4
	25	27	21	26	22
Number driven by :—					
Electricity	3	5	5	5	4
Compressed air	22	22	16	21	18
	25	27	21	26	22
Coal produced by :—	tons.	tons.	tons.	tons.	tons.
Electricity	7,217	30,089	44,015	57,867	48,115
Compressed air	198,519	249,541	218,492	133,020	66,795
Total coal produced by machines	205,736	279,630	262,507	190,887	114,910
Percentage of total production for year	10·43	11·24	10·94	7·4	4·75

Production of Coke in British Columbia.

Year.	Quantity (long tons).	Value* (£).
1913	287,296	272,129
1914	236,784	223,243
1915	246,003	232,605
1916	268,617	261,609
1917	161,971	230,518
1918	189,795	323,870
1919	89,604	185,462

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* Values converted to £ sterling at the rate of 1 dollar = 4*s.* 2*d.*

† This production is obtained by adding "Home Consumption" and "Sold for Export."

Yukon Territory.*

In the Yukon territory both coal and lignite are widely distributed, the chief localities being the Whitehorse, the Tantalus, and the Rock Creek coal areas.

Probably the most important of these coal-bearing districts is the Tantalus area, which crosses Lewes River midway between Whitehorse and Dawson, where the Tantalus mine, the Tantalus Butte property and the Five Fingers mine are situated. In the Whitehorse and Tantalus areas the coal measures occur mainly in the Tantalus conglomerate, but also, to some extent, in the upper portions of the underlying Laberge series. These rocks are all of Jurassic-Cretaceous age.

The coals in the Rock Creek area, so far as is known, are all lignites, and occur in beds of Tertiary age.

WHITEHORSE COAL AREA.

This area is situate about 12 miles to the south-east of Dugdale, a siding on the White Pass and Yukon railway. The coal is anthracitic in character, and the measures have been traced for at least 12 miles. Three main seams have been discovered measuring 9 ft. 8 in., 10 ft. 4 in., and 2 ft. 6 in., respectively, in thickness. With the exception of a short tunnel and a few open-cuts, this area is entirely undeveloped. The coal is quite accessible, as a spur, with a favourable grade, could be built from the railway to the site. Considering the proximity of this area to the Whitehorse copper deposits and to the town of Whitehorse, the coal constitutes a fuel reserve which should prove of considerable value in the comparatively near future.

TANTALUS COAL AREA.

The coal in this area ranges from high-grade lignite to coking bituminous coal, and belongs to two different periods of formation. The upper horizon occurs near the top of the Tantalus conglomerate, and includes the seams found at the Tantalus mine and at Tantalus Butte and corresponds with the Kootanic series of the interior. The lower horizon occurs in the upper portions of the Laberge series, and is represented by the seams at Five Fingers mine.

The Tantalus conglomerate extends across Lewes river to the north of Tantalus for at least 2½ miles, and continues towards the south, up the valley of Nordenskiold river for about 17 miles, and wherever any considerable thickness of these beds is exposed, coal measures are to be seen; from this it may be inferred that the district contains a considerable reserve of coal.

The Tantalus mine is on the left bank of the Lewes river about 190 miles below Whitehorse. The coal crops out on the river bank, and is, therefore, well situated for economic mining. Three seams, dipping in an easterly direction, have been opened up, varying in thickness, but averaging 7 ft. 6 in., 6 ft. 6 in. and

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* An Investigation of the Coals of Canada. Department of Mines, Canada, 1912, p. 116.

3 ft. of coal, respectively. There is about 7 feet of rock between the upper and middle coal, and 4 feet between the latter and the lower coal. Only the lower two seams are worked at present. Although the seams are dirty, the coal could easily be sorted, but as the wages are 20s. 10d. and board for underground work, and 16s. 8d. and board for surface work, no sorting has yet been attempted. According to the analyses which have been made, the coal should make good coke, and it is hoped that it will prove useful for smelting when the copper deposits of Whitehorse and the minerals in the other parts of the Yukon become further developed.

At Tantalus Butte, across the river from the Tantalus mine, the same measures outcrop, but dip to the west, showing the presence of an intervening synclinal fold. The best seam exposed contains 5 feet of good, firm, clean-looking coal with 1 foot of coal and shale at the bottom. The general condition of the strata resembles that at the Tantalus mine.

The Five Fingers Mine is situated on the east side of the river, about 10 miles north of the Tantalus mine. A considerable quantity of coal has been shipped, but the old workings are now closed owing to the entrance to the mine becoming dangerous. The coal is 3 ft. 6 in. to 4 ft. 0 in. in thickness. Later, a slope was driven, and a second seam, 2 ft. 0 in. in thickness, opened out. The coke made from the coal from this seam is firm and coherent.

ROCK CREEK COAL AREA.

Lignite and lignitic coals occur extensively in Tertiary beds in portions of Yukon territory. Probably the largest known area is that of Rock Creek, extending from the Klondyke Valley in a W.N.W. direction, to Cliff Creek, a distance of about 70 miles, the width of the area averaging probably 10 miles.

Coal-mining operations have been carried on at several places, including Cliff Creek; Coal Creek, a tributary of the Yukon river; and Coal Creek, a tributary of Rock Creek. Only the second of these has been worked since 1908.

At a point a little over 7 miles from the Klondyke river, and some 20 miles from Dawson, there occur two seams of lignite, 3 feet and 2 to 3 feet thick, respectively, separated by a clay parting about a foot thick. A quantity of fuel was obtained from one of these seams, and sent to Dawson. The most important coal property in the Rock Creek area is that on Coal Creek (tributary of the Yukon). The property comprises 960 acres of coal land, the mine being situated 12 miles from the mouth of the creek and connected with the mouth of Coal Creek by 12 miles of railway, whence the coal can be transported to Dawson by barges. The coal occurs in a number of seams varying from 4 to 20 feet in thickness.

At the north-west end of the Rock Creek area, on Cliff Creek, a small stream which enters the Yukon from the right, 53 miles below Dawson, a seam of lignite, 11 feet in thickness (including partings), was opened out in 1902, and a considerable quantity was shipped by barge to Dawson.

NEWFOUNDLAND.

On the south side of Bay St. George there is a coal-bearing area, about 3 miles wide and 7 miles in length. The quality of the coal in some of the larger seams is excellent. An analysis of a 4½-foot seam gave: moisture 3·036 per cent.; fixed carbon 60·142 per cent.; volatile matter 30·344 per cent.; sulphur 1·963 per cent.; ash 4·515 per cent.

In the valley of the Humber river there is a narrow synclinal trough of coal-measures with a known length of eleven miles. The highly-tilted coal-bearing beds contain as many as fifteen seams, nine of which, one foot or over in thickness, have an aggregate thickness of 18 feet 8 inches. The coal is of good quality.

* Until recently no serious attempt was ever made to prospect, much less to mine these coal deposits. Two companies have recently carried out prospecting operations, and although the existence of large deposits of workable coal seems probable, not enough work had been done up to the end of 1919 to convert probability into a certainty.

The most promising area is owned by the St. George's Coal Fields Company, and lies about ten miles from the coast and seven miles from the Reid Newfoundland railway, between the Robinson, Middle Barachoix, and Northern Feeder Rivers, and comprises four miles of level, thickly-wooded country. On this area, sixteen seams have been located, and it is reasonably certain that others exist. The four principal coal-seams are: Jukes 4 ft. 8 in. to 6 ft. 0 in. thick; Howley 4 ft. 2 in.; Cleary 2 ft. 2 in.; and Murray 5 ft. 4 in.

The coal is bituminous, free from sulphur, and of good quality. There is one small seam of cannel.

Commercially the locality is not inconvenient, as it would not cost very much to make Crabbes, ten miles to the west, a good summer port; and La Poile, forty miles south, is a splendid harbour, open all the year round. Lack of financial backing prevents, at present, the development of these areas, but the Government is doing its utmost to encourage the company and has granted them many valuable concessions, besides binding itself to pay a bonus of 4s. 2d. per ton on every ton of coal produced.

A promising seam of coal was discovered at Little River, Codroy, by the Reid Newfoundland Company, and a considerable amount of development work was done there.

TRINIDAD.

Beds of lignite are found in the eastern part of the island of Trinidad in two districts. In the eastern district the coal-bearing strata have a thickness of 2,317 feet with 34 lignite seams, ranging in thickness from 2 inches to 4 feet 3 inches, and containing altogether 38 feet 6 inches of coal. Of this, 19 feet is made up of seams over 3 feet thick. In the Cunapo district two seams have been traced for about one mile. The upper seam is

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* Canadian Mining Journal, Dec. 1919, Vol. XL, p. 947.

about 2 feet thick and the lower about 3 feet, although both vary greatly within short distances. The coal, to be of commercial value, requires washing.

Analyses of Trinidad lignites.[*]

<table>
<tr><th rowspan="2">District.</th><th colspan="4">Proximate Analysis.</th><th rowspan="2">Sulphur.</th><th rowspan="2">Coke.</th><th rowspan="2">Cal. Value.</th><th rowspan="2">Evap. Power.</th></tr>
<tr><th>Moisture.</th><th>Fixed Carbon.</th><th>Volatile Matter.</th><th>Ash.</th></tr>
<tr><td></td><td>Per cent.</td><td>Per cent.</td><td>Per cent.</td><td>Per cent.</td><td>Per cent</td><td>Per cent.</td><td>Cals.</td><td>lb.</td></tr>
<tr><td>[†]Cunapo ...</td><td>12·29</td><td colspan="2">79·39</td><td>8·32</td><td></td><td>42·57</td><td></td><td></td></tr>
<tr><td>Between Oropuchy and Moruga (in cliffs)... ...</td><td>13·7</td><td>34·0</td><td>32·9</td><td>19·4</td><td>5·06</td><td></td><td>4,378</td><td>8·17</td></tr>
</table>

ASIA.

British North Borneo.

Brown coal is widely distributed in British North Borneo. The principal areas where mining is being carried on are: (1) The Sadong River field, where an area of 45 square miles has been prospected, containing two seams, 2 feet 6 inches and 3 feet thick, respectively. (2) The Brooketon field, on the south-west side of Brunei Bay, where very thick seams are found; the two seams now being worked are 28 and 26 feet in thickness, respectively. The beds probably extend under the sea as far as the north end of the island of Labuan, where coal outcrops in the hills. The area underlain by coal-seams is considerable, but its extent has not been ascertained. The coal is of good quality. (3) The Silimpopon coalfield, near Cowie Harbour, which is one of the most important fields in North Borneo. A seam 5 feet 10 inches thick, a shallow synclinal basin, is being mined. The reserve of coal in the Silimpopon area has been estimated to be :—

	Tons.
Actual reserve	5,600,000
Probable reserve	70,000,000

The coals occasionally show patches of resin; they may be classed among the lower grades of bituminous coal, or among the higher grades of lignite.

Coal-mining operations were carried on at Silimpopon by the Cowie Harbour Coal Co., and 41,781 tons, valued at £21,204, were obtained in 1912 and shipped from Cowie Harbour. Both ocean liners and ocean steamers were supplied with this coal for bunkering, and a considerable quantity was shipped as cargo to eastern ports. No later information is available.

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[*] Coal Resources of the World, 1913, Vol. II, p. 572.

[†] Trials have been made with the Cunapo coal on the Government railway and the results, although not good, are by no means discouraging provided that it could be made into briquettes.

*Analyses of British North Borneo Coals.**

Locality.	Coalfield.	Proximate Analysis.				Ultimate Analysis.							Cal. value.
		Volatile matter.	Fixed carbon.	Moisture.	Ash.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.	Ash.	Moisture.	
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cals.
Brooketon ...	S.W. of Brunei Bay	40·24	46·70	11·48	1·58					0·36			6,667
Brooketon ...	Kubong					72·27	5·20	14·28		0·30	1·85	6·10	
Silimpopon ...	—					70·64	5·62	8·80	0·85	2·47	11·62		7,416

* Coal Resources of the World, 1913, Vol. I, pp. 89–93.

Labuan.

The Labuan Coalfields Co., Ltd., were some years ago actively engaged in developing a seam 9 feet thick at Coal Point.

The output of the Colony was 91,227 tons in 1910, and 5,736 tons in 1911 (January to April). The mines were then closed down.

Brunei.*

Coal mines are worked by the Rajah of Sarawak at Brooketon in the Muara district, at the mouth of Brunei River, and at Baung Tawar on the Brunei River.

Production of Coal in Brunei.

Year.	Quantity (long tons).	Average value per ton Brooketon.	Average value per ton Labuan.
1915	30,413	15*s.* 3*d.*	
1916	27,447	17*s.* 6*d.*	
1917	27,621	25*s.* 8*d.*	30*s.* 4*d.*
1918	29,565	30*s.* 4*d.*	35*s.* 0*d.*
1919	26,274	35*s.* 0*d.*	39*s.* 8*d.*

INDIA.†

About 98 per cent. of the coal production of India is obtained from strata belonging to the Gondwana system. The various rock groups which compose the Gondwana system range in time from the Upper Carboniferous to the Lower Cretaceous periods of the European geological record. The corresponding subdivisions are seen in the accompanying classification :—

GONDWANA SYSTEM	*Upper*			**Umia Plant Beds**	*Etc.* *Neocomian*	CRETACEOUS
				Jabalpur Series	*Portlandian* *Kimmeridgian* *Corallian*	JURASSIC
				Kota Stage	*Oxfordian* *Callovian* *Bathonian* *Bajocian*	
				Rajmahal Stage (Rajmahal and Sylhet Traps included)	*Aalenian* *Toarchian* *Pliensbachian* *Sinemurian* *Hettangian*	
				Parsora—Maleri Stage	*Rhaetian* *Keuperian*	TRIASSIC
	Lower		**Kamthi Group**	**Panchet Stage**	*Conchylian*	
		Damuda Series		**Raniganj Stage**	*Thuringian*	PERMIAN
				Ironstone Shale	*Punjabian*	
				Barakar Stage	*Artinskian*	
				Karharbari and Talchir Beds	*Uralian* *Etc.*	CARBONIFEROUS

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* Reports on the State of Brunei (Annual.)

† Memoirs and Records of Geological Survey of India. Reports on the Production and Consumption of Coal in India (Annual). Annual Statements of Sea-borne Trade of British India.

There are coal-seams in the Jurassic rocks of Cutch and in the Cretaceous beds of Assam, but the only coal being worked outside the Gondwana fields is of Tertiary age. The only part of the Gondwana system which is important from the coal-producing point of view is that known as the Damuda series and in this series the Raniganj and Barakar stages both include valuable coal seams.

In general, the Gondwana coal of Peninsular India may be described as a laminated bituminous coal, in which dull and bright layers alternate. Much of it does not cake freely, while a not inconsiderable proportion will not do so at all. However, fairly good coke can be made from the coal of certain seams. The ash in the Bengal coal which is brought to the market averages from 10 to 15 per cent., which means that coal with less than 10 per cent. of ash is uncommon, while coal with more than 15 per cent. does not, as a rule, find a ready sale. In the producing fields of Hyderabad, the Central Provinces and Central India, the ash content is much higher.

Total Output from Gondwana Fields of Bengal, Bihar and Orissa, Central India, Central Provinces and Hyderabad.

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	15,814,304	97·57
1914	16,039,261	97·42
1915	16,673,237	97·48
1916	16,863,466	97·74
1917	17,814,524	97·81
1918	20,322,892	98·08
1919	22,238,802	98·28

Bengal, Bihar and Orissa.

*Daltonganj.** (Lat. 24° 2′ : Long. 84° 7′.)—This field is situated in the valleys of the Koel and Amanat rivers, in the Palaman district of Chota Nagpur. Its total area is about 200 square miles, of which the coal-bearing strata (Karharbari Barakars) occupy only about 30 square miles. The distribution of the coal appears to be extremely irregular, and there is apparently only one seam from which the hope of extracting any large quantity of coal may be entertained. Its maximum thickness is 29 feet, but it thins out in all directions.

*Analysis of Two Samples from Rajhara.**

	Per cent.
Water	8·40
Fixed carbon	49·37
Volatile matter	27·63
Ash	14·60

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* Mem. Geol. Surv. India, vol. XLI, p. 60.

The field was re-opened in 1901. During the period under review it has produced as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	85,345	0·53
1914	81,680	0·50
1915	85,785	0·50
1916	76,298	0·44
1917	79,627	0·44
1918	81,816	0·39
1919	63,250	0·28

*Giridih.** (Lat. 24° 11′ : Long. 86° 23′.)—The area of this field is about 11 square miles, of which 7 square miles are occupied by Barakar rocks. Faults are frequent, and there are numerous dykes of basalt and mica-peridotite which have destroyed thousands of tons of coal. There are many seams of varying thickness and quality, but the most important which have been worked are :—

1. Karharbari Lower Seam : area, 7 square miles; average thickness, 15 feet 4 inches; total quantity of coal, 105,000,000 tons. Composition :—

	Per cent.
Fixed carbon	66·84
Volatile matter	24·42
Ash	9·15

2. Karharbari Upper Seam (now almost exhausted) : area, 150 acres; average thickness, 6 feet; quantity, 1,500,000 tons.

3. Bhaddoah Seam : area, 913 acres; average thickness, 6 feet; quantity, 11,500,000 tons. Composition :—

	Per cent.
Fixed carbon	60·85
Volatile matter	22·51
Ash	15·84
Sulphur	0·80

The remaining seams have an aggregate thickness of 66 feet, but much of the coal in them is of inferior quality.

In 1894, Dr. Saise calculated that there were 82½ million tons of coal which might be profitably extracted.

Coal has been mined at Giridih since 1857, but the railway connection was not established till 1871; since then vigorous development has taken place. During the period under review the field has produced as follows :—

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* Mem. Geol. Surv. India, vol. XLI, p. 41.

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	806,810	4·98
1914	825,026	5·01
1915	872,647	5·10
1916	866,055	5·02
1917	824,007	4·52
1918	846,592	4·09
1919	950,045	4·20

Jherria. (Lat. 23° 44′ : Long. 86° 29′.)—This coalfield is roughly elliptical in shape and has a maximum length from east to west of about 23 miles, the greatest breadth being about 10 miles. The total area of the coal-bearing rocks is about 150 square miles. The best seams occur in the Barakar beds, where 18 are known varying from 5 to 100 feet in thickness. In seams numbers 12 and 13, with thicknesses of 11½ and 5 feet, respectively, Ward calculated in 1890 that there were 1,287 million tons of coal.

In the overlying Raniganj beds there are numerous thin seams which were considered worthless by earlier observers. Subsequent working has shown that at least one of these is valuable.

According to Simpson, it is difficult to give even an approximate estimate of the available coal, for recent borings and sinkings have proved that much of the coal is burnt and valueless. On the other hand, the extent of the burnt zone is not known.

In 1919 it was estimated by an official committee that the Jherria reserves of higher-grade coal approximated to 482 millions of tons, and, as in the Raniganj field, that there are in addition large quantities of second-class and lower-grade quality.

The existence of coal in Jherria was known in 1777, but it was not until 1894 that railway connection was first obtained.

Jherria coal resembles Raniganj coal in appearance. Several of the seams furnish good coking coal. The following are proximate analyses of the coal.*

——	Moisture.	Fixed carbon.	Volatile matter.	Ash.	Calorific value.
	Per cent.	Per cent.	Per cent.	Per cent.	Calories
Raniganj or upper measures (2 samples).	1·68	57·26	30·61	10·45	7,195
Barakar or lower measures (22 samples).	1·25	63·77	23·21	11·78	7,197

Mem. Geol. Surv. India, vol. XLI, p. 54.

The production during the period under review was as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	8,608,310	53·11
1914	9,146,653	55·55
1915	9,140,800	53·44
1916	8,950,318	51·87
1917	9,783,788	53·72
1918	10,952,010	52·85
1919	12,145,917	53·68

Jainti.—This is a small area of Barakar rocks, about 11½ square miles in extent, in the south of the Santal Parganas, and in the neighbourhood of the Adjai river. The seams are thin and the coal is of poor quality. No estimates of reserves are available. The field was opened in 1914; since then, it has produced as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1914	8,162	0·04
1915	40,730	0·24
1916	75,089	0·44
1917	86,894	0·48
1918	140,373	0·68
1919	154,850	0·68

Ramgarh-Bokaro.—The Bokaro coalfield lies some two or three miles west of the termination of the Jherria field. Its greatest length, from east to west, is about 40 miles; its maximum breadth does not exceed 6½ miles. Its area is 220 square miles. The coal seams are numerous, and some of them are of great thickness. One seam, worked at the Bokaro colliery, is 90 feet thick. In many places the seams are damaged by intrusive igneous rocks. The most productive portion of the field lies between the Kunar river and the eastern boundary. The general quality of the coal is said to be inferior to that of Jherria. Hughes mentions 1,500 million tons as being the probable quantity of available fuel. Fermor estimated, recently, that 365 million tons were available in one portion of the eastern field. According to Whitworth, there are 200 million tons of coal available, at a conservative estimate, in the Kargali seam alone, east of the Kunar river. The coal is of good coking quality, and Whitworth believes that 650 millions of tons, at least, of this coal will be available, if this characteristic persists to the west of the Kunar river, where the seam has already been located.

Ramgarh.—This field lies along the valley of the Damuda river, some 5 miles to the south of the Bokaro coalfield. Its area is about 40 square miles. The rocks of the Barakar stage contain a large number of thick coal seams, of which some are of fair quality but much disturbed. The quantity available is probably about 5 million tons.

Mining was commenced in the Ramgarh-Bokaro field in 1908, and its yield, during the period under review, was as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	7,024	0·04
1914	16,920	0·10
1915	10,232	0·06
1916	197,255	1·14
1917	360,760	1·98
1918	541,977	2·62
1919	722,682	3·19

*Raniganj.**—This is the largest of the Damuda Valley coalfields, and covers an area of about 500 square miles. Coal seams are found in both the Barakar and Raniganj sub-divisions of the Damuda series. According to Blanford, four seams, with an aggregate thickness of 69 feet, have been worked in the Barakar beds, and 10 seams, with an aggregate thickness of 110 feet, in the Raniganj stage, while many other seams are known to occur. It has been calculated that the Raniganj field alone contains over 20,000 million tons of coal of all kinds ; most of this, however, is of inferior quality, and only 518 million tons have been estimated to be of better, or so-called "first class," quality.

By far the greater portion of the output is drawn from the Raniganj or upper measures, and the major portion of this comes from the Dishargarh and Sibpur seams. The Sanctoria, Ghusie and Raniganj seams, also, are important. Thick seams are worked in the lower measures. Particulars of some important seams are given below :—

Quality.	Seam.	Average thickness.	Length of outcrop.	Total quantity available.	
		Feet.	Miles.	Million tons.	
First Class ...	Dishargarh ...	18	12	300	
	Sanctoria ...	10	2	30	
	Sibpur ...	15	9	188	
					518
Medium Class ...	Ghusie ...	12	3	50	
	Raniganj ...	15	2	40	
	Laikdih-Salanpur	20	10	270	
					360
				Total ...	878

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* Mem. Geol. Surv. India, vol. III (1863) ; vol. XLI, p. 43 (1913). Rec. Geol. Surv. India, vol. LII, p. 46 (1921).

The coal is hard, dull to bright-black in colour, and occurs in alternating laminæ of bright, jet-like, and dull shaly coal. It is bituminous, but only that from certain seams has good coking properties. The following is a summary of analyses of coals from this field* :—

——	Moisture.	Fixed carbon.	Volatile matter.	Ash.	Calorific value in calories.	
	Per cent.	Per cent.	Per cent.	Per cent.	Calculated.	Experimental.
Raniganj or upper measures (22 samples).	4·76	53·42	32·16	9·66	6,835	6,767
Barakar or lower measures (3 samples).	1·65	64·05	24·76	9·54	7,571	7,348

The distance to which the coal-bearing beds of the Raniganj field extend in a south-eastern direction, where they are overlapped by alluvium, is unknown at present. Recent borings, however, point to their extension eastwards to a very great distance, but they are overlain by the higher beds of the series, and are at a considerable depth.

The earliest attempts at mining in this field date back to 1812, but little profitable work was done until 1843, when an amalgamation of the leading firms then at work took place. In 1854, the East Indian Railway reached the field and since then progress has been uninterrupted.

Production for the period under review was as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	5,327,248	32·87
1914	4,946,295	30·04
1915	5,484,596	32·07
1916	5,535,307	32·09
1917	5,376,022	29·52
1918	6,368,519	30·73
1919	6,815,126	30·11

Sambalpur (Lat. 21°27′ : Long. 84°1′).—This field is included in the Rampur or Raigarh-Hingir coalfield, which has an area of about 300 square miles. Early exploration by borings was unsatisfactory and the outcrops only showed coaly layers, only a few inches in thickness. In 1891, a seam, 1 foot thick, was discovered, accidentally, in sinking the foundations for a railway bridge. This led to a re-survey of the eastern end of the field, and four seams, varying in thickness from 4 to 8 feet, were proved by boring, but, with the exception of the Ibbridge seam, all of them contained more than 30 per cent. of ash. The thickness of the Ibbridge seam, in the best section, is 7 feet 10 inches, including a band of bituminous shale, 8 inches thick. The average composition of two samples is* :—

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* Mem. Geol. Surv. India, vol. XLI, p. 49.

	Per cent.
Water	8·5
Fixed carbon	53·6
Volatile matter	22·6
Ash	15·3

The first colliery was established in 1909. The production for the period under review was as follows :—

Year.	Quantity† (long tons).	Per cent. of total output in India.
1913	42,805	0·26
1914	60,883	0·37
1915	58,825	0·34
1916	59,737	0·35
1917	52,892	0·29
1918	51,038	0·25
1919	45,574	0·20

Central India.

Umaria (Rewah). (Lat. 23° 39′ : Long. 80° 53′.)—This, the smallest of the rich coalfields of the Rewah Gondwana basin, has an area of six square miles, and is on the Umrar river, a tributary of the Mahanadi. On the north, the Barakar coal measures dip under younger deposits and are probably continuous with those of the Korar field, 12 miles distant. There are six seams, varying from 3 to 12 feet in thickness. The coal is non-coking, and some of it is of good quality, as the following analysis shows‡ :—

	Per cent.
Moisture	5·46
Fixed carbon	66·71
Volatile matter	19·71
Ash	8·12

It is said that the present output is not up to this quality.

In 1885, Hughes estimated that 55 million tons of coal were available within a depth of 500 feet. In 1902, Oates estimated the total quantity of proved workable coal at 24 million tons.

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* Mem. Geol. Surv. India, vol. XLI, p. 86.

† Hingir-Rampur total included (Rec. Geol. Surv. India, vol. LII, p. 44, 1921.

‡ Mem. Geol. Surv. India, vol. XLI, p. 76.

A branch of the Bengal-Nagpur Railway passes through the centre of the field.

The development of the coalfield was commenced in 1882, and, in 1900, the Government of India, which, up to that time, had worked the collieries on royalty, handed them over to the Rewah Durbar. There are also the undeveloped coalfields of Korar, Johilla, Sohagpur, and Singrauli in Rewah State.

Production for the period under review was as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	148,978	0·92
1914	152,906	0·93
1915	139,680	0·82
1916	200,285	1·16
1917	198,407	1·09
1918	199,975	0·96
1919	182,141	0·80

Central Provinces.

The coalfields of this Province lie along three definite lines. (1) Mohpani and the Pench Valley to the north and south of the Satpura highlands, (2) Ballarpur down the Wardha-Godavari Valley, and (3) the fields of Sirguja, Korea, and Korba in the Chhattisgarh drainage area of the Mahanadi river.

Mohpani. (Lat. 22° 46′ : Long. 78° 54′.)—The Mohpani is the most northerly of the several small coalfields of the Satpura Gondwana basin. The exposed coal measures (Barakars) occupy an area of rather more than 1 square mile. Their limits are ill-defined, being overlapped by younger rocks or obscured by alluvium. There are four seams, with average thicknesses of 17, 25, 5, and 6½ feet respectively.

The average composition of eleven samples of the coal is shown below* :—

	Per cent.
Moisture	5·28
Volatile matter	29·81
Fixed carbon	48·34
Ash	16·57

In 1912, the amount of workable fuel was estimated at rather more than 8 million tons.

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* Rec. Geol. Surv. India, vol. XLVI, 1915, p. 59.

The field was opened in 1862, and, since 1904, has been worked by the Great Indian Peninsula Railway Company.

Production during the period under review was as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	64,887	0·40
1914	59,744	0·37
1915	55,086	0·32
1916	48,395	0·28
1917	71,693	0·39
1918	78,792	0·38
1919	85,299	0·38

Pench Valley. (Lat. 22° 7′ : Long. 79° 0′.)—The Pench valley or Barkoi field has an area of 7·4 square miles, and is one of the Chhindwara coalfields, which are situated on the southern flanks of the Satpura Range, in the valleys of the Tawa, Kanhan and Pench rivers.

Three workable seams have been proved, measuring 9½, 5, and 5 feet thick, respectively. The quantity of coal available is said to be not less than 100 million tons. The following is an analysis of the coal (average of 3 samples)* :—

Fixed carbon	53·5 per cent.
Volatile matter	22·8 ,,
Ash	23·6 ,,

The field was opened-up in 1905. In the period under review its production was as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	89,805	0·55
1914	95,679	0·58
1915	103,152	0·60
1916	154,548	0·9
1917	204,502	1·12
1918	267,303	1·29
1919	285,356	1·26

Ballarpur (Chanda) (Lat. 19° 50′ : Long. 79° 24′). Ballarpur is one of the small coalfields of the Chanda district which extend along the valley of the Wardha river for a distance of about 72 miles.

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* Mem. Geol. Surv. India, vol. XLI, p. 95.

The Ballarpur field lies partly in the State of Hyderabad, west of the Wardha river. The average thickness of the coal proved in the early borings was 40 feet, which, over an area of 1½ square miles, gives a reserve of 60 million tons. Boring on the British side of the river, in 1905, proved 36 million tons of workable coal over an area of 2 square miles. An analysis of a sample of the coals gave the following results* :—

Moisture	11·10 per cent.
Fixed carbon	45·47 ,,
Volatile matter	31·56 ,,
Ash	11·87 ,,

Exploitation commenced in 1905, and, in 1913, the colliery, which up to that time had been worked profitably by the Government, was sold to a private firm.

Output for the period under review was as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	80,959	0·50
1914	89,292	0·54
1915	94,880	0·56
1916	84,889	0·49
1917	95,303	0·52
1918	135,375	0·65
1919	126,366	0·56

Hyderabad.

Singareni (Lat. 17° 31′ : Long. 80° 16′). The great belt of Gondwana rocks (near the north-western end of which, Warora is situate) stretches down the Godavari valley as far as Rajahmundry, and, at one or two places, the equivalents of the coal-bearing Gondwana rocks in Bengal are found cropping out from below the Upper Gondwana rocks. One of these occurrences, near Yellandu, in the Nizam's Dominions, forms the well-known coalfield of Singareni. The coal measures (Barakars) occupy about 9 square miles, but they are almost completely covered by younger deposits. Four coal seams have been found. Their respective thicknesses are as follows :—

	Feet.
Thick coal, alternating bands of coal and shale	30 to 40
New coal, containing 20 per cent. of inorganic matter	6½
Stove coal, containing 30 per cent. of inorganic matter	4½
King seam	3¾ to 7

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* Mem. Geol. Surv. India, vol. XLI, p. 90.

The King seam is the only one being worked, but part of the Thick coal is considered workable.

The following analysis has been published* :—

	King Seam. Per cent.
Moisture	7·60
Fixed carbon	56·50
Volatile matter	25·25
Ash	10·65

The coal from the King seam is a dull, hard, non-coking steam coal, considered to be about 15 per cent. inferior to the best Bengal coal.

In 1887, Hughes reported that the King and Thick coal seams contained, at a moderate estimate, 156 million tons of coal.

In 1894, Saise considered that there was a total quantity of 45 million tons in the King seam alone.

Work was commenced at Singareni in 1887.

Production during the period under review was as follows:—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	552,133	3·41
1914	555,991	3·38
1915	586,824	3·43
1916	615,290	5·56
1917	680,629	3·74
1918	659,122	3·18
1919	662,196	2·93

TERTIARY COALFIELDS.

Coal of Tertiary age is found in the foot-hills throughout almost the whole of extra-peninsular India, from Baluchistan on the north-west to Assam on the north-east. It also occurs in Sind, Rajputana, Burma, and in the Andaman Islands. The most frequent occurrence is in association with nummulitic limestones of Eocene age, although the richest deposits, namely those of north-east Assam, are probably Miocene.

The Tertiary coals are usually bright, jet-like, and non-laminated lignites, containing a larger proportion of moisture and volatile hydrocarbons than the Gondwana coals; many of them are very friable, and susceptible to disintegration on exposure. As a rule, they do not cake, and the proportion of ash is usually small.

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* Mem. Geol. Surv. India, vol. XLI, p. 98.

The total outputs from the Tertiary coalfields of Baluchistan, Assam, Punjab, and Rajputana were :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	393,705	2·43
1914	425,002	2·58
1915	430,695	2·52
1916	390,843	2·26
1917	398,394	2·19
1918	399,601	1·92
1919	389,235	1·72

Baluchistan.

Khost. (Lat. 30° 13′ : Long. 67° 38′)—Tertiary coal is found in the hills flanking the frontier section of the Sind-Pishin Railway. The Khost collieries are in a wedge of strata let down by parallel faults. The two seams worked have an average thickness of 26 and 57 inches, respectively. Mining was commenced in 1877. A good deal of dust-coal is converted into compressed fuel. The coal is non-coking. Production during the period under review was as follows :—

Year.	Quantity (long tons).	Per cent of total output in India.
1913	45,585	0·28
1914	39,557	0·24
1915	35,782	0·21
1916	32,995	0·19
1917	29,517	0·16
1918	29,600	0·14
1919	23,703	0·13

Sor Range, Mach, etc. (Lat. 30° 0′ : Long. 67° 20′.)—A number of thin coal seams, associated with sandstones, occur in clay shales of Middle Eocene age, in the Sor Range, to the east and south-east of Quetta. The best seams vary from 2 to 3 feet in thickness. The analysis of a coal from Mach is as follows* :—

	Per cent.
Moisture	10·9
Fixed Carbon	41·0
Volatile matter	33·1
Ash	15·0

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* Mem. Geol. Surv. India, vol. XLI, p. 34.

The average analysis of two seams at Digari in the Zarakhu valley is as follows* :—

	Per cent.
Moisture	7·7
Fixed Carbon	44·7
Volatile matter	43·3
Ash	4·3

During the last twenty-five years, a large number of small mines have been opened by small contractors, of whom few work on any regular system.

Production during the period under review was as follows :—

Year.	Quantity (long tons).	Per cent of total output in India.
1913	7,347	0·05
1914	8,677	0·05
1915	7,825	0·05
1916	9,168	0·05
1917	11,268	0·06
1918	13,525	0·07
1919	10,625	0·05

Assam.

Makum.—The Makum field is the best known of several coalfields lying along the lower ranges of the hills, which form the southern boundary of the Lakhimpur and Sibsagar districts. The coal-bearing rocks, to which the Makum field belongs, stretch for 40 miles to the north-east and can be traced for 100 miles to the south-west, along the northern front of the Patkai range. The most valuable seams occur in the east of the Makum field, between the Trap and Namdang streams. Throughout this ground the existence of a coal seam, from 15 to 80 feet in thickness, averaging, probably, not less than 50 feet, has been proved. In 1900, Harris estimated that above the natural drainage of the Ledo and Namdang streams this great seam, alone, contains a total quantity of 90 million tons of coal.

The average compositions of three samples from the Upper Ledo colliery, representing an aggregate thickness of 49 feet,

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Mem. Geol. Surv. India, vol. XLI, p. 35.

and of five samples from the Tikak colliery, representing an aggregate thickness of 47 feet, are given below* :—

	Upper Ledo. Per cent.	Tikak. Per cent.
Moisture	1·80	2·09
Fixed carbon	55·59	58·99
Volatile matter	40·15	37·25
Ash	2·46	1·67

The coal is a brownish-black to black, hard, bright variety, with an irregular cleavage. It is a valuable gas coal, and produces an excellent coke, while its calorific value compares favourably with that of Raniganj coal. The most serious defects of the fuel are the large amount of sulphur which it contains, and the state of " small " in which it is placed on the market.

Similar coal is being won, in smaller quantities, from the Nazira field, which lies to the south-west of Makum, though most of this is of a hard variety.

Large scale operations commenced on the Makum field in 1882. The production of the Assam fields for the period under review was as follows :—

Year.	Quantity (long tons).	Per cent of total output in India.
1913	270,862	1·67
1914	305,160	1·86
1915	311,296	1·82
1916	287,315	1·66
1917	301,480	1·65
1918	294,484	1·42
1919	291,734	1·29

Punjab (Salt Range).

Jhelum District, Dandot. (Lat. 35° 39′ : Long. 73° 0′.)—The Dandot plateau is one of the few localities where the coal deposits of the Salt Range have been found to be economically workable. The only available seam varies in thickness from 18 to 39 inches, and forms a basin under the nummulitic limestone. In 1887, it was estimated to contain some 5 million tons of coal. A more recent estimate considerably reduced this amount.

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* Rec. Geol. Surv. India, vol. XLVI, 1915, p. 66.

The coal is a friable lignite, and is much jointed. An analysis gave the following result* :—

	Per cent.
Moisture	6·13
Fixed carbon	47·17
Volatile matter	36·81
Ash	9·89

The quality of the general run of the coal is probably considerably inferior to this.

The mines at Dandot and Pidh were worked for the North Western Railway from 1884 to 1912, when they were sold to private owners.

The production of the district for the period under review is given in a later paragraph.

Mianwali District. (Lat. 32° 40′ : Long. 71° 20′.)—The Isa Khel deposits are situate in the Trans-Indus extension of the Salt Range, in the neighbourhood of Isa Khel, in the Mianwali district. A fairly continuous seam, with an average thickness of 27 inches, can be traced for a distance of 6½ miles. It has been calculated that nearly 500,000 tons of coal might be extracted from above the natural water-level. Thin and inconstant seams of Jurassic coal occur also in the same neighbourhood, and insignificant quantities are sometimes raised from them. The Isa Khel coals are bright-black, fairly hard lignites; the following are representative analyses† :—

——	Kalanagh.	Kuch.	Mulla Khel-Sultan Khel (average of 21 samples).
	Per cent.	Per cent.	Per cent.
Moisture	4·04	10·19	9
Fixed carbon	42·20	46·12	40
Volatile matter	24·16	22·74	37
Ash	25·12	18·60	10
Sulphur	4·39	2·35	4

The Marakwal mine was opened in 1903. The output for the period under review is given in a later paragraph.

Shahpur District. (Lat. 32° 34′ : Long. 72° 28′.)—Coal seams similar to those of Dandot in the Jhelum district occur farther west, in the Shahpur district. The average thickness of the main seam is about 3 feet. The mines are worked by local contractors

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[*] Mem. Geol. Surv. India, vol. XLI, p. 110.

[†] Mem. Geol. Surv. India, vol. XLI, p. 111.

in a small way, and the output is subject to large fluctuations.

The following analyses have been made* :—

	Jhakar Kot. Per cent.	Tejuwala. Per cent.
Moisture	7·60	5·08
Fixed carbon	46·50	37·31
Volatile matter	35·66	31·01
Ash	10·24	26·60

The production from this and the other fields of the Punjab already described for the period under review was as follows :—

Year.	District.			Percentage of total output in India.
	Jhelum (long tons).	Mianwali (long tons).	Shahpur (long tons).	
1914	45,867	1,557	6,879	0·33
1915	51,613	2,029	4,269	0·34
1916	44,944	817	1,688	0·28
1917	40,322	2,916	6,631	0·28
1918	39,651	5,152	5,615	0·24
1919	35,845	5,822	5,226	0·21

Rajputana.

BIKANER.

Palana. (Lat. 27° 51′: Long. 73° 19′.)- A seam of coal, 4 to 8 feet thick, was discovered during the sinking of a well, at a depth of 212 feet from the surface. On opening-up, the seam was found to be persistent over a considerable area, and to vary from 3 to 30 feet in thickness. A colliery was established in 1898.

The coal is a resinous woody lignite, of a brownish-black colour, which becomes very friable on exposure to the air. Experiments have been made in the briquetting of this material. Analyses are as follows† :—

	Coal.	Briquette.	Briquette No. 2.
	Per cent.	Per cent.	Per cent.
Moisture	22·90	14·84	9·32
Fixed carbon	38·16	38·78	38·80
Volatile matter	35·36	40·64	44·36
Ash	3·58	5·74	7·52

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* Bibliography of Indian Geology, by T. N. D. La Touche, 1917, p. 111.

† Mem. Geol. Surv. India, vol. XLI, p. 114.

Production during the period under review was as follows :—

Year.	Quantity (long tons).	Per cent. of total output in India.
1913	18,781	0·12
1914	17,211	0·10
1915	17,796	0·10
1916	13,841	0·08
1917	6,045	0·03
1918	11,334	0·05
1919	14,760	0·06

OUTSTANDING FEATURES OF THE WAR PERIOD.

During the period under review, the expansion in the coal mining industry of India continued its uninterrupted progress in spite of the war, output rising from 16,208,009 tons in 1913 to 22,628,037 tons in 1919. The annual figures for production and value, during the years 1913 to 1919, are shown in Table A.

In the year 1914, the increase of output was small, on account of the outbreak of the war, and the after effect of disastrous floods during 1913. The best coals of Bengal and Bihar were in demand for war purposes, but the rest of the trade was affected adversely, and many of the smaller mines were shut down. Owing to the presence of an enemy warship in eastern waters, the greater portion of the coal required for bunkering the transports was carried by rail. Later on, after the bulk of the expeditionary forces had left India, there was a serious curtailment of export traffic. The fact, however, that no foreign coal could be delivered at ports like Bombay or Karachi proved advantageous to the Indian trade. Towards the end of the year, as soon as the harvesting season was over, there was a big influx of labour to the mines, and the output increased.

In *1915*, the outputs of the larger collieries, working the best seams, increased, but smaller mines, and those exploiting inferior coals, showed a decrease. Poorer financial facilities, the closing down of much internal industry, and the general restriction of commerce, forced a good deal of extra coal on the market, early in the year, and brought down prices. This reacted on the industry generally, and especially affected the small owners and those mining inferior coal. As the year went on, increasing quantities of coal had to be transported by rail, until, at its close, practically all that was used in India, excluding small amounts destined for a few towns in the southernmost parts of the Empire, was so carried.

In *1916*, the Indian coal trade passed through many vicissitudes. Until March there was a considerable shortage of wagons, and cholera broke out during the hot weather. Later in the year there was an unusual and severe epidemic of malaria which affected production severely. In addition, a late harvest and good crops caused shortages of labour at the mines and curtailed the output.

Conditions in *1917* were dominated by war requirements. All the coals of better quality were requisitioned by the Government for military purposes, at fixed prices; and such coals, naturally, had priority of transport. The result was that the demand for the non-requisitioned coals exceeded the available supply, and prices ranged far above those of the requisitioned grades. By the end of September, there was not a mine in the Jherria coalfield, capable of raising coal, which was not being worked. Towards the end of the year a Coal Controller was appointed. During 1917, the effects of scarcity of machinery and plant, and the inability to obtain replacements and additions from Europe, began to be felt.

In *1918*, practically the whole of the Indian coal trade was under the Coal Controller, and one of the first steps taken was to restrict the output of collieries working the poorer classes of coal. All coal, except that of distinctly inferior quality, was requisitioned at prices fixed by the Controller, on the basis of cost of production *plus* a certain profit; the result was that practically every consumer in India received his coal through that officer. The largely increased output shows that Indian colliery owners did not suffer much from scarcity of machinery and plant from overseas.

GOVERNMENT CONTROL OF COAL.

The distribution of coal throughout India became a matter of acute difficulty in 1917, on account of the special conditions caused by the war. Before the war, the bulk of the coal consumed on the western side of India was carried by sea from Calcutta, and the railways serving the coalfields of Bengal and Bihar and Orissa were laid out and equipped for transporting some three million tons of coal per year to the Calcutta docks for shipment. When shipping failed, all this coal, with the exception of a very small percentage sent by sea on Admiralty account, had to be transported by rail across India. The burden thrown upon the railways in this respect is illustrated by the table given below, which exhibits a progressive decrease in the downward or short-lead rail-borne coal traffic, and a progressive increase in the upward or long-lead coal traffic.

Upward and Downward Despatches of Coal by the East Indian and Bengal-Nagpur Railways, from 1914 *to* 1918.

Year.	Upward (long tons).	Downward (long tons).
1914	5,298,513	7,894,149
1915	6,132,187	7,132,265
1916	8,084,741	6,391,911
1917	8,493,207	5,753,387
1918	9,476,994	5,582,454

In the first instance, a Coal Committee was appointed to deal with the situation, and a system of distribution by priority was introduced; but as the work in connection with the distribution of coal to industrial concerns in India, in addition to meeting demands on Admiralty and military account, became heavier and more complicated, the Government of India decided, in November, 1917, to vest all powers in a single officer, designated the Coal Controller.

The main difficulty with which the Coal Controller was faced at the outset was a shortage of labour in the coalfields due, among other causes, to late and very heavy rains and to epidemics. He therefore imposed restrictions on the output of a large number of collieries producing inferior classes of coal, so as to prevent labour being diverted from collieries producing a better class of coal. Some collieries were restricted as to the monthly tonnage which they might raise and despatch, while others were only allowed to manufacture soft coke for domestic purposes.

In order to reserve railway wagons for the movement of grain and fodder about India, the Coal Controller prohibited the transport of brick-burning coal and dust, except for purposes of very special importance, and throughout the year 1918 public lighting in the streets of Calcutta and Bombay was reduced to a minimum, and shops and places of amusement were required to curtail their illumination as much as possible.

At the end of 1916, only a portion of the coal was requisitioned on Government account, but the whole output of all collieries working first-class coal was requisitioned in June, 1917, and early in 1918, owing to a shortage, the output of certain collieries working second-class coal was temporarily placed under requisition.

The prices paid for the requisitioned coal varied, but were approximately as follows:—

Varieties of coal.	1917.		1918.					
			January.		April.		August.	
	Rs. a. p.	*s.* *d.**	Rs. a. p.	*s.* *d.**	Rs. a. p.	*s.* *d.**	Rs. a. p.	*s.* *d.**
Desherghur, Poniati	5 8 0	7 4	5 12 0	7 8	6 0 0	8 0	6 6 0	8 6
Selected Jherrias ...	4 6 0	5 10	4 12 0	6 4	5 0 0	6 8	5 6 0	7 2
First class Jherrias...	4 0 0	5 4	4 8 0	6 0	4 12 0	6 4	5 0 0	6 8
Second class Jherrias					3 8 0	4 8	3 11 0	4 11

* Values converted to £ sterling at the rate of 15 rupees = £1.

During 1918, the bunkering of steamers in Bombay, Karachi, and Calcutta was controlled by Government.

The prices varied from time to time, but were fixed, finally, as under :—

	Rs.	s. d.	
Calcutta ...	15	20 0	per ton, trimmed into bunkers.
Bombay ...	28	37 4	,, ,, ,,
Karachi ...	27 & 24	36/- & 32/-	,, ,, ,,

The relaxation of controlling measures began early in 1919, the initial step being taken in January by the removal of restrictions placed on collieries raising inferior coal, followed in February by a relaxation of the requisition of coal from second-class collieries. Also, a certain quantity of coal in each case was set free. In April, the appointment of Coal Controller was abolished, some part of his duties, in connection with the transportation of coal along the railways, being carried on by an officer under the Railway Board.

IMPORT AND EXPORT TRADE.

Table D shows the relation between the imports of foreign coal and the exports of Indian coal during the period under review. There was a marked decrease under both headings as a result of the war, the average quantities imported and exported annually during the period 1914-1918 being 148,522 tons and 539,422 tons, respectively, as compared with 466,162 tons and 814,475 tons for the quinquennial period immediately preceding the war. The importation of coal from the United Kingdom, Australia and Natal, fell to comparatively small amounts, while that from Japan ceased entirely.

The distribution of Indian export coal is shown in Table F; Ceylon and the Straits Settlements continuing to be India's chief customers. During the period reviewed, Ceylon took, on an average, 359,496 tons of Indian coal annually and the Straits Settlements 88,782 tons, as compared with averages of 466,965 and 187,525 tons, respectively, for the previous quinquennial period. Exports to Sumatra ceased in 1917.

COKE AND PATENT FUEL.

Coke is now manufactured in India to the extent of about 500,000 tons per annum in the Bengal coalfields from low-grade coal, but only small quantities, aggregating some 1,800 tons annually, are exported. There are no recorded exports of patent fuel, and figures apparently referring to this represent re-exports of foreign origin.

CONSUMPTION OF COAL IN INDIA.

The following statement gives an estimate of the quantity of coal (Indian and foreign) consumed during 1918 in the various industries, etc., of the country. The figures must be regarded as approximations only :—

	Estimated Consumption (long tons).	Per cent. of total.
Railways	5,881,000	28·4
Admiralty and Royal Indian Marine	1,358,000	6·6
Bunker coal	1,180,000	5·7
Jute mills	1,045,000	5·0
Cotton mills	968,000	4·7
Iron and brass foundries and engineering workshops ...	1,307,000	6·3
Inland steamers	485,000	2·3
Brick and tile factories, potteries, and cement works	477,000	2·3
Tea gardens	225,000	1·1
Port Trusts	163,000	0·8
Paper mills	166,000	0·8
Colliery consumption and wastage	2,487,000	12·0
Other forms of industrial and domestic consumption ...	4,960,000	24·0
Total	20,702,000	100·0

In order to obtain comparative prices of Bengal coal in the principal centres of industry in India the freight has to be added to the f.o.r. prices. The following table shows the freight per ton of coal, by rail, for full wagon loads at owner's risk (owner to load and unload) from the Raniganj and Jherria fields in 1918 :—

To	From Raniganj.		From Jherria.	
	Rs. a. p.	*s. d.**	Rs. a. p.	*s. d.**
Calcutta	2 6 0	3 2	3 4 0	4 4
Cawnpore	6 6 0	8 6	6 1 0	8 1
Jubbulpore	7 1 0	9 5	6 13 0	9 1
Delhi	8 6 0	11 2	8 1 0	10 9
Lahore	10 3 0	13 7	9 15 0	13 3
Bombay	12 2 0	16 2	12 2 0	16 2
Karachi	13 9 0	18 1	13 5 0	17 9

* Values converted to £ sterling at the rate of 15 rupees = £1.

The average rates of freight per ton of coal by sea from Calcutta during 1916, 1917, 1918 and 1919 were as follows :—

To	1916.		1917.		1918.		1919.	
	Rs. a. p.	£ *s.* *d.**	Rs. a. p.	£ *s.* *d.**	Rs. a. p.	£ *s.* *d.**	Rs. a. p.	£ *s.* *d.**
Bombay	—	—	—	—	55 0 0	3 13 4	33 12 0	2 5 0
Madras	14 8 0	0 19 4	21 14 0	1 9 2	27 0 0	1 16 0	14 0 0	0 18 8
Rangoon	11 12 0	0 15 8	15 12 0	1 1 0	20 0 0	1 6 8	13 8 0	0 18 0

* Values converted to £ sterling at the rate of 15 rupees = £1.

LABOUR.

The average number of persons employed daily in the coal mining industry in India for the years 1914 to 1918, inclusive, was 165,322.

The classes from which the labour is recruited are mainly agricultural, and treat mining as a secondary occupation. A favourable monsoon and an abundant harvest deplete the coal-fields of labour, as the cultivator only turns to the mines when his resources from his land are exhausted. The labour in and about the collieries is inefficient, as the following *per capita* output table shows :—

	Above and below ground (long tons).	Below ground only (long tons).
1913	111·8	172·1
1914	108·8	166·7
1915	106·8	160·2
1916	110·2	169·3
1917	108·9	173·5
1918	108·3	171·8
1919	111·1	177·2

The following table shows the fluctuations of the wages of the underground and surface workers at a colliery in Bengal, for the years 1914-1918, inclusive.

Daily Wages at the Collieries of a Coal Company in Bengal.

In January of	Raniganj.				Nimcha.				Sanktoria.				Sodepore.				Kuldiha.			
	Miners.		Black-smiths.		Miners.		Blacksmiths.		Miners.		Black-smiths.		Miners.		Black-smiths.		Miners.		Black-smiths.	
	Rs.	*d.**	Rs.	*d.**	Rs.	*d.**	Rs.	*d.**	Rs.	*d.**	Rs.	*d.**	Rs.	*d.**	Rs.	*d.**	Rs	*d.**	Rs.	*d.**
1914 ...	·375	6	·3125	5	·75	1*s.*	·4375–·5	7–8	·375	6	·375	6	·4219	7	·4948	8	·3438	6	·6406	10
1915 ...	·375	6	·3125	5	·75–·8125	1*s.*–1*s.* 1*d.*	·5–·5625	8–9	·375	6	·375	6	·4219	7	·4948	8	·3438	6	·6406	10
1916 ...	·375	6	·3125	5	·75	1*s.*	·5	8	·375	6	·375	6	·42	7	·5	8				
1917 ...	·4	6	·4	6	·75	1*s.*	·625	10	·4	6	·4	6	·42	7	·5	8	·375	6	·4	6
1918 ...	·4	6	·4	6	·75	1*s.*	·75	1*s.*	45	7	·5	8	·45	7	·5	8	·4	6	·5	8

* Values converted at the rate of 15 rupees = £1.

ACCIDENTS.

The total number of fatal accidents during 1918 was 212, giving a death-rate of 1·11 per 1,000 persons employed.

During recent years there has been a great advance in the use of electricity in the coal mines of Bengal and Bihar for haulage, pumping, lighting and ventilation. There is, however, little or no coal won by electric cutters.

GROWTH OF THE INDUSTRY.

The growth of the coal mining industry in India may be roughly gauged from the following table, showing the number of joint-stock coal companies and their total paid-up capital. The total amount of capital employed in the industry cannot be stated, as that employed by private companies and individuals is unknown.

	Number of Companies.	Rs. (lakhs).	£
1913–14	142	725	4,833,333
1914–15	145	747	4,980,000
1915–16	150	752	5,013,333
1916–17	159	755	5,033,333
1917–18	173	802	5,346,666
1918–19	192	844	5,626,666
1919–20	236	868	5,786,666

TABLE A.—*Production of Coal in India.**

Year.	Quantity (long tons).	Value (£).
1913	16,208,009	3,798,137
1914	16,464,263	3,907,380
1915	17,103,932	3,781,064
1916	17,254,309	3,878,564
1917	18,212,918	4,511,645
1918	20,722,493	6,017,215
1919	22,628,037	10,119,257

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* Rec. Geol. Surv. India, vol. LII, p. 28 (1921).

TABLE B.—*Average Price per ton of Coal extracted from Mines in each Province in India.*

Province.	1914.		1915.		1916.		1917.		1918.		1919.	
	Rs. a. p.	* *s.* *d.*	Rs. a. p.	* *s.* *d.*	Rs. a. p.	* *s.* *d.*	Rs. a. p.	* *s.* *d.*	Rs. a. p.	* *s.* *d.*	Rs. a. p.	* £ *s.* *d.*
Assam	7 0 1	9 4	6 15 6	9 4	6 15 10	9 4	7 0 7	9 5	7 2 8	9 7	7 10 0	0 10 2
Baluchistan	9 9 0	12 9	9 11 9	13 0	10 8 10	14 1	11 0 11	14 8	14 13 8	19 10	15 12 0	1 1 0
Bengal	3 13 10	5 2	3 6 2	4 6	3 8 9	4 9	3 15 1	5 3	4 14 10	6 7	5 0 0	0 6 8
Bihar and Orissa	3 3 4	4 3	2 15 6	4 0	2 15 10	4 0	3 5 10	4 6	3 14 3	5 2	4 1 0	0 5 5
Central India	3 0 0	4 0	3 0 0	4 0	3 0 0	4 0	3 6 2	4 6	4 8 1	6 0	3 10 0	0 4 10
Central Provinces ...	4 7 3	5 11	4 4 6	5 9	4 1 1	5 5	4 1 3	5 5	5 9 0	7 5	5 7 0	0 7 3
North West Frontier Province.	5 0 0	6 8	5 0 0	6 8	5 0 0	6 8	14 0 0	18 8	4 0 0	5 4		
Punjab	5 3 0	6 11	5 6 11	7 3	6 14 5	9 2	7 8 8	10 1	11 5 0	15 1	11 13 0	0 15 9
Rajputana	3 14 9	5 3	3 15 2	5 3	3 12 4	5 0	4 5 8	5 10	6 5 5	8 5	6 9 0	0 8 9
Burma	—	—	6 0 0	8 0	—	—	—	—	—	—	—	—
Hyderabad (Nizam's Territory).	5 0 0	6 8	6 0 0	8 0	6 0 0	8 0	6 0 0	8 0	6 0 0	8 0	6 0 0	0 8 0

* Values converted at the rate of 15 rupees = £1.

TABLE C.—*Average Value of Coal at the Pit's Mouth contrasted with that declared at the time of export.*

Year.	Value at the pit's mouth per ton.					Declared export value per ton.				
				*					*	
	Rs.	a.	p.	*s.*	*d.*	Rs.	a.	p.	*s.*	*d.*
1913... ...	3	8	0	4	8	9	13	0	13	1
1914... ...	3	9	0	4	9	8	13	0	11	9
1915... ...	3	5	0	4	5	9	3	0	12	3
1916... ...	3	6	0	4	6	9	2	0	12	2
1917... ...	3	11	0	4	11	9	5	0	12	5
1918... ...	4	6	0	5	10	10	9	0	14	1
1919... ...	4	8	0	6	0	11	14	0	15	10

The declared export value is thus about two and a half times the value of the coal at the pit's mouth.

The average value given above may be compared with the pit's mouth value of coal in other countries. It will be seen that Indian coal is the cheapest of all.

	Rs.	*a.*	*p.*	*s.*	*d.**	Average of five years ending
France	9	7	2	12	7	1913
Germany	7	13	2	10	0	1913
United Kingdom ...	13	15	0	18	7	1919
Australia	5	11	10	7	8	1916
United States	4	9	5	6	1	1916
Japan	5	11	10	7	8	1917
South Africa	4	6	5	5	10	1916
India	3	10	7	4	11	1918

TABLE D.—*Imports and Exports of Coal, Coke and Patent Fuel during the years* 1914 *to* 1918.†

Year.	Imports (long tons).	Exports (long tons).
1914	418,758	579,746
1915	190,654	753,042
1916	34,033	881,741
1917	44,818	408,117
1918	54,346	74,466
Average	148,522	539,422

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* Values converted at the rate of 15 rupees = £1.

† Rec. Geol. Surv. India, vol. LII, p. 35 (1921).

TABLE E.—*Imports of Coal, Coke and Patent Fuel into India.*

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Coal :—							
United Kingdom	169,213	156,863	30,149	1,418	5,875	7,580	4,656
Natal ...	136,730	39,140	15,292	10,799	3,857	13,020	18,089
Transvaal ...	31,104	40,355	26,448	—	—	—	—
Australia and New Zealand	51,344	33,419	28,106	12,301	22,554	4,857	3,329
Portuguese East Africa	77,579	58,742	52,312	3,587	9,080	22,680	16,880
Japan ...	93,103	32,232	18,069	—	—	—	—
Other Countries	63,586	39,612	3,075	1,852	2,422	5,065	4,734
	622,659	400,363	173,451	29,957	43,788	53,202	47,688
Coke	17,121	12,729	10,241	4,074	1,026	1,144	957
Patent Fuel ...	5,154	5,666	6,962	2	4	—	30
Government Stores	212,941	54,738	12,379	3,593	1,637	13,095	205
TOTAL ...	857,875	473,496	203,033	37,626	46,455	67,441	48,880

TABLE F.—*Exports of Coal and Coke from India (Domestic Produce).*

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Coal :—							
Ceylon	425,165	340,289	554,885	548,105	299,070	51,935	296,192
Straits Settlements (including Labuan)	197,385	111,024	99,363	141,714	80,077	10,279	116,304
Sumatra	102,718	83,698	64,263	104,067	8,474	—	41,756
Other Countries ...	32,218	42,933	33,290	84,944	19,457	12,121	53,678
TOTAL	757,486	577,944	751,801	878,830	407,078	74,335	507,930
Coke	1,669	1,802	1,241	2,911	1,039	131	607

* The exports of Indian coal shown for fiscal years in this table are those shipped on private account only, and do not include bunker coal for the Admiralty or Royal Indian Marine.

MALAY STATES.*

Selangor.

Coal of Tertiary age was discovered in 1908 seven miles west of Rawang railway station, on the southern boundary of the Rantau Forest Reserve.

The coal measures consist of coals, shales and sandstones resting upon older rocks. The seams, which crop out at the surface, dip at an angle of 13°, increasing to 35° in one part of the field.

Two seams are known and worked, but the evidence so far obtained from bores would appear to indicate that the lower seam does not extend throughout the coalfield. The upper or "Main Seam" varies from 30 to 70 feet in thickness, and the lower or "Great Seam," where at present worked, is 30 feet in thickness.

A mean proximate analysis of the coal gave the following results:—

	Per cent.
Moisture	14·50
Ash	4·45
Fixed carbon	42·85
Volatile hydrocarbons...	38·20
	100·00

The calorific value of the dry coal is from 11,000 to 11,300 B.Th.U.

The coal is pitch-black in colour and breaks with a conchoidal fracture, and being hard it does not soil the fingers. It has a specific gravity of 1·2 to 1·3. It is non-coking, and burns with a long flame, giving a white and pulverulent ash, which does not clinker.

A concession has been taken up by the Malayan Collieries, Ltd., at Batu Arang, near Kuala Lumpur, on the Rawang coalfield, and, although the reserves cannot be estimated with any degree of exactitude until boring has proved the measures at lower depths, sufficient coal has been proved to give an estimated output of 400,000 tons for 30 years.†

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* Annual Reports on the Federated and Unfederated Malay States.

† Board of Trade Journal, Nov. 27, 1919, p. 662.

The Malayan Collieries had their development work well in hand by the end of 1914, though the operations were hindered by transport difficulties.

The making of railway connections by the Federated Malay States Railway Department was in active progress through somewhat difficult country, and was completed in 1915. The output of these collieries in 1915 amounted to 11,523 tons, and in 1916 to 101,846 tons, the output being restricted by a shortage of skilled labour and by the absence of certain essential machinery and supplies. These circumstances induced the Mines Department to assent to the northern seam being worked open-cast, within certain limits. Also, a scheme for a deep boring had to be abandoned, owing to the impossibility of securing plant. In 1918, in spite of influenza epidemics, the output was 168,740 tons, making a total of 437,388 tons since production commenced. In 1918, the output was distributed as follows :—

	Tons.
Federated Malay States Railways ...	67,437
Mines	66,500
Other Federated Malay States Consumers	14,915
Exported	19,888

Some 9,500 acres have been selected.

The imports of coal to Selangor have decreased from 10,253 tons in 1913 to 1,031 tons in 1916, owing to the establishment of these collieries.

PATENT FUEL.

Selangor.

*The Malayan Collieries, Ltd., intend to make briquettes of the coal found near Kuala Lumpur. Experiments made in England showed that excellent briquettes could be produced. A briquetting plant is being introduced capable of turning out 100 tons per day.

Output of Coal in Selangor.

Year.	Quantity (long tons).
1914	2,000†
1915	11,523
1916	101,846
1917	155,279
1918	168,740
1919	191,293

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* Colliery Guardian, Jan. 24, 1919, p. 197 ; Nov. 14, 1909, p. 1305.

† Raised during development work.

Imports of Coal and Coke into the Federated Malay States.

Year.	Quantity (long tons).					
	Selangor.		Perak.		Pahang.	
	Coal.	Coke.	Coal.	Coke.	Coal.	Coke.
1913	10,253	1,323	39,119	385	90	70
1914	7,680	832	30,342	139·5	10	81
1915	6,868	316	20,123	114	60	—
1916	1,031	682	2,682	295	50	76
	Value (£).*					
1913	18,451	4,305	61,102	1,245	157	171
1914	14,493	3,070	57,336	496	13	196
1915	14,313	1,435	35,960	417	105	1,798
1916	2,347	4,097	10,207	1,860	155	183

NOTE.—Information since 1916 is not available.

Imports of Coal into Johore.

Year.	Quantity (long tons).	Value.* (£).
1914	229	471
1915	1,070	1,560
1916	3,362	6,744
1917	720	2,357
1918	553	2,812
1919		

AUSTRALIA.†

The coal resources of Australia are summarized on p. 122.

From the table on p. 122, it will be seen that the production of coal for the whole of the Commonwealth of Australia fell from

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* Values converted to £ sterling at the rate of 1 F.M.S. dollar = 2*s.* 4*d.*

† Annual Reports of the Department of Mines, New South Wales. Annual Reports of the Secretary for Mines, Victoria. Annual Reports of the General Manager, State Coal Mines, Victoria. Annual Reports of the Under Secretary for Mines, Queensland. Annual Reports of the Department of Mines, Western Australia. Annual Reports of the Secretary for Mines, Tasmania. Trade and Customs and Excise Revenue of the Commonwealth of Australia (Annual).

12,417,867 tons in 1913 to 10,566,725 tons in 1919, a decrease of 1,851,142 tons.

The exports of coal (exclusive of bunkers) from the Commonwealth, during the fiscal year ended June 30, 1919, amounted to 528,093 tons, valued at £387,422, of which 528,060 tons, valued at £387,379, were exported from New South Wales.

Owing to the war, these figures are considerably below those of normal years.

The following table shows the consumption of coal in Australia during the six years 1913-1918. This estimate is arrived at by adding the imports to the home production and deducting the exports (including bunker coal taken by oversea vessels).

Year.	Quantity of Coal Consumed.		
	Home Produce (long tons).	Produce of other countries (long tons).	Total (long tons).
1913	8,671,491	4,449	8,675,940
1914	8,944,867	23,066	8,967,933
1915	9,250,592	6,580	9,257,172
1916	8,266,215	11,068	8,277,283
1917	8,985,599	65,512	9,051,111
1918	9,866,323	22,334	9,888,657

The coal supplied for bunkering purposes, during the fiscal year ended June 30, 1919, was 722,808 tons.

Throughout 1918 and 1919, the coal trade of the Commonwealth was much affected, not only by strikes of colliers, but also by scarcity of shipping, by the maritime strike, and by other adverse circumstances which it was considered should be overcome during 1920.*

COKE.

Notwithstanding the large deposits of coking-coal in Australia, there was, prior to the war, a fairly considerable amount of coke imported from abroad. In 1917-18, however, these imports were negligible.

In recent years the coking industry has made considerable progress, and it provides a profitable means for the disposal of the small coal, which, until recent years, was wasted.

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* Under Secretary of Mines for New South Wales. Mining Magazine, Vol. XXII, 1920, p. 160.

A small quantity of coke is made in Queensland. It is estimated that the total amount of coke consumed for smelting purposes in that State, during 1917, was 73,000 tons, of which 13,000 tons were produced locally and 60,000 tons were obtained from New South Wales.

*The Actual and Probable Coal Reserves of Australia are summarized as follows :—**

—	Actual Reserves (in millions of tons).			Probable Reserves (in millions of tons).			Total.
	Class of Coal.			Class of Coal.			
	Anthracite.	Bituminous Coal.	Lignite.	Anthracite.	Bituminous Coal.	Lignite.	
AUSTRALIA :							
New South Wales	—	—	—	—	118,439	—	118,439
Victoria	—	40	—	—	12	31,114	31,166
Queensland ...	99	1,931	66	560	11,762	800	15,218
Tasmania ...	—	—	—	—	66	—	66
Western Australia	—	—	153	—	—	500	653
TOTAL ...	99	1,971	219	560	130,279	32,414	165,542

* Coal Resources of the World, 1913, Vol. I, p. xxix.

Production of Coal in Australia.

—	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
New South Wales	10,414,165	10,390,622	9,449,008	8,127,161	8,292,867	9,063,176	8,631,554
Victoria ...	596,897	620,251	590,968	420,098	501,156	505,734	535,574
Queensland ...	1,037,944	1,053,990	1,024,273	907,727	1,048,473	983,193	931,631
Western Australia	313,818	319,210	286,666	301,526	326,550	337,039	401,713
Tasmania ...	55,043	60,794	64,536	55,575	63,412	60,163	66,253
TOTAL ...	12,417,867	12,444,867	11,415,451	9,812,087	10,232,458	10,949,305	10,566,725

Exports of Coal from the Commonwealth of Australia (Domestic Produce).

To	Quantity (long tons).						
	Calendar year 1913.	Six months to June 30, 1914.	Fiscal years ending June 30.				
			1915.	1916.	1917.	1918.	1919.
United Kingdom	100	95	6,861	50	28	—	—
Union of South Africa	—	—	—	2,712	—	—	—
Canada	16,538	2,522	2,082	2	—	—	—
Ceylon	—	—	—	18,914	—	—	—
Hong Kong	—	3,000	1,457	—	—	—	8,105
India	63,324	17,033	80,699	50,075	36,653	21,023	19,250
Mauritius	1,573	1,203	11,330	2,351	1,910	756	—
Straits Settlements	155,393	132,174	84,100	47,272	40,993	11,819	32,652
Papua	2,709	1,237	6,150	3,594	4,062	3,246	5,206
British Pacific Possessions	41,597	17,905	54,477	42,578	53,481	50,592	24,956
New Zealand	477,787	252,851	357,299	314,213	320,274	198,575	290,875
Other British Possessions	—	1,058	—	—	3,223	—	—
Total to British Possessions	759,021	429,078	604,455	481,761	460,624	286,011	381,044
Belgium	12	—	—	—	—	—	—
France	—	—	1,834	—	—	—	934
Mexico	44,629	27,559	8,244	—	—	—	—
United States	93,755	68,441	105,623	40,456	3,202	—	—
Alaska	17,242	7,469	—	—	—	606	—
Chile	688,578	320,674	236,017	205,383	81,421	4,295	18,420
Ecuador	8,433	12,362	30,497	8,174	—	—	—
Peru	53,926	20,476	21,558	23,414	15,156	—	3,487
China	1,553	421	—	—	—	—	—
Philippine Islands	49,502	32,940	94,602	10,243	—	11,764	10,172
Java	267,437	188,505	169,073	98,625	29,394	11,953	40,940
Foreign Pacific Possessions	114,417	55,935	98,824	61,942	56,755	42,094	73,096
Other Foreign Countries	—	—	1,018	—	—	—	—
Total to Foreign Countries	1,339,484	734,782	767,290	448,237	185,928	70,712	147,049
Total Exports	2,098,505	1,163,860	1,371,745	929,998	646,552	356,723	528,093
Bunker Coal*	1,647,870	854,876	1,314,317	980,533	891,267	619,911	722,808
TOTAL	3,746,375	2,018,736	2,686,062	1,910,531	1,537,819	976,634	1,250,901

* Foreign and inter-state.

Production of Coke in Australia.
(long tons).

Year.	New South Wales.	Queensland.	Total.
1913	298,612	14,942	313,554
1914	304,800	16,685	321,485
1915	417,753	17,085	434,838
1916	437,587	17,904	455,491
1917	455,587	13,399	468,986
1918	608,492	14,437	622,929
1919	424,773	4,562	429,335

NOTE.—No information is available regarding coke production in the other States of Australia.

Exports of Coke from the Commonwealth of Australia (Domestic Produce).

To	Quantity (long tons).						
	Calendar Year 1913.	Six Months to June 30, 1914.	Fiscal Years ending June 30.				
			1915.	1916.	1917.	1918.	1919.
Mauritius	—	11	—	—	—	—	—
Straits Settlements	111	—	—	—	98	794	—
Papua	—	43	—	45	19	7	—
British Pacific Possessions ...	88	131	199	315	130	219	—
New Zealand	1,291	866	1,439	723	1,305	464	952
Other British Possessions ...	17	—	88	—	—	—	13
Total to British Possessions	1,507	1,051	1,726	1,083	1,552	1,484	965
United States	5,714	—	4,703	4,782	1,738	—	—
Chile	—	223	4,985	2,780	1,607	21	—
Peru	302	—	149	—	—	299	—
Japan	—	—	—	—	5	—	20
Foreign Pacific Possessions ...	3	1,239	1,495	16,247	24,926	34,206	29,568
Philippine Islands	289	651	406	200	—	684	251
Java, etc.	219	415	865	161	4,898	606	3,372
Total to Foreign Countries	6,527	2,528	12,603	24,170	33,174	35,816	33,211
TOTAL	8,034	3,579	14,329	25,253	34,726	37,300	34,176

New South Wales.

The most productive coal seams of New South Wales are found in the Permo-Carboniferous strata, which are estimated to cover an area of 16,550 square miles, extending from Newcastle on the north to Mount Kembla on the south, a distance of some 120 miles, with a breadth of 70 miles, at their widest dimension, from the coastline on the east, near Sydney, to Lithgow on the west.

Towards the north, south and west, the seams rise towards the surface and crop out in the neighbourhood of Newcastle, Bulli, and Lithgow, where the three chief productive coalfields are situate. The coal measures rise to the east, also, under the South Pacific Ocean, in which direction their extent is unknown. The deepest part of the basin is in the vicinity of Sydney, where the Sydney Harbour Colliery has been sunk to the top seam, locally known as the Wallarah, at a depth of 2,884 feet.

Three main divisions of the coal-measure strata are usually recognized :—*

> The Upper, or Newcastle Coal Measures, containing twelve seams of coal. In the aggregate, they contain 35 to 40 feet of workable coal.
>
> The Middle, or Tomago, or East Maitland Coal Measures, containing six seams of coal, varying from 3 to 7 feet in thickness. In the aggregate, they contain about 18 feet of workable coal.
>
> The Lower, or Greta Coal Measures, containing an aggregate of about 20 feet of coal.

The following table shows the order and approximate thickness of the seam of coal in the three divisions :—

Upper Coal Measures.		Middle Coal Measures.		Lower Coal Measures.	
Name of Seam.	Approx. Thickness.	Name of Seam.	Approx. Thickness.	Name of Seam.	Approx. Thickness.
	feet.		feet.		feet.
Wallarah ...	11	Top, or Donaldson's.	4 to 6	Upper Greta...	14 to 32
Great Northern	20	Big Ben, or Tomago Thick	7 to 10	Lower Greta...	3 to 11
Fassifern ...	Up to 25	Tomago Thin	2½ to 3		
Upper Pilot ...	Not workable.	Scotch Derry	9 to 10½		
Lower Pilot ...	Do.	Rathluba ...	5½ to 11		
Australasian ..	7 to 20	Morpeth ...	4½ to 8		
Burwood ...	6 to 8				
Nobby... ...	Not workable.				
Dirty	6 to 10(*a*)				
Yard	3				
Borehole ...	4 to 22—usually 8 to 9				
Sandgate ...	4 to 6				

(*a*) Splits into two seams in places.

† The Borehole seam is estimated to underlie the Wallarah seam by some 1,200 to 1,300 feet.

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* The Coal Resources of New South Wales; Geological Survey of New South Wales, E. F. Pittman, 1912, p. 7.

† Trans. Inst. Mining Eng., London, Vol. III, p. 125, T. E. Forster.

Of the 12 seams in the Upper Coal Measures, only five were being worked in 1918, viz., Wallarah, Great Northern, Australasian, Burwood, and Borehole. By far the largest amount of work has been done in the Borehole seam, which is the chief seam worked in the immediate neighbourhood of Newcastle, and which has produced enormous quantities of exceedingly fine coal, the quality being especially suitable for household use and for gas-making. It is freely exported to other parts of the Commonwealth, to New Zealand, and to the West Coast of America.

The Wallarah is the principal seam worked in the southern and western coalfields, where it yields a good steam coal, largely used on the State railways and for bunkering steamers. The coal has the following average analysis :—*

	Per cent.
Hygroscopic moisture	0·97
Fixed carbon	65·26
Volatile hydrocarbons	23·10
Ash	10·67
	100·00

None of the other seven seams, so far as prospected in the Newcastle district, has proved sufficiently good to be profitably worked.

The average composition of the coal from the Upper or Newcastle Coal Measures in the northern coalfield, as calculated from the analyses of 78 samples, is as follows :—

	Per cent.
Hygroscopic moisture	2·01
Fixed carbon	53·27
Volatile hydrocarbons	36·01
Ash	8·71
	100·00

Sulphur ... ... 0·468 per cent.
Evaporative power ... ... 12·7 lb.

It has been estimated that the aggregate thickness of the coal in the Middle Coal Measures is about 40 feet, and that the total thickness of coal actually worked is about 18 feet.

In 1918, the Greta seams of the Lower Coal Measures, which are chiefly worked in the neighbourhood of Maitland and Cessnock, contributed 3,758,970 tons towards the total coal production of New South Wales (9,063,176 tons), that from the Borehole seam of the Upper Coal Measures being 1,341,909 tons. The coal from the Greta seams is hard and can be worked economically, as it makes a minimum quantity of "smalls." It is exceedingly good in quality, and is useful for gas-making, household purposes, and, also, for steam-raising. It contains a rather high percentage of sulphur.

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* Proc. Australasian Inst. Min. Eng., No. 10, p. 240.

The average composition of this coal in the northern coalfield, as calculated from the analyses of 51 samples, is as follows :—

	Per cent.
Hygroscopic moisture	1·84
Fixed carbon	49·52
Volatile hydrocarbons	41·61
Ash	7·03
	100·00
Sulphur	1·291 per cent.
Evaporative power	13·07 lb.

The coal seams of the State are generally remarkable for the rapid variation in the thickness of the coal and of the bands which they contain. The Permo-Carboniferous strata have in various places been disturbed by intrusions of igneous rocks which, in some instances, have completely cindered the seams in close proximity to the intrusive masses.

In 1913, 10,414,165 tons of coal were produced in the State, and the coal (exclusive of bunkers) exported amounted to 2,097,097 tons, being the largest quantity ever despatched.

In 1914, there was a decrease of 23,543 tons in the production. The coal trade during that year was in a fairly prosperous condition, although the effects of the European war were felt during the latter months, when many collieries in all the districts were working short time.

In 1915, 9,449,008 tons were produced, and 927,225 tons were exported,* being a decrease in the output of 941,614 tons compared with that of the previous year. In the northern district the reduction was 16 per cent., in the southern district 18 per cent., while the western district showed an increase of 9 per cent. Exported coal showed a decrease of 443,764 tons, owing to State restrictions, the effect of which was somewhat counterbalanced by the increased quantity of coal used for home consumption—this, for the first time, reached 50 per cent. of the total output. These export restrictions were felt much more severely by the collieries in the Newcastle area of the northern district than by those elsewhere.

The production from the Greta seams was nearly double that from the Borehole seam, compared with only one-sixth in 1903.

The net decrease in the foreign exports of coal (inclusive of bunkers) from Newcastle in 1916 compared with 1913 amounted to 1,836,679 tons, the chief decreases being in the exports to New Zealand (331,000 tons), Chile (696,000 tons), Mexico, Germany, United States, Philippine Islands, Straits Settlements, and Sandwich Islands, amounting in all to about 1½ million tons.

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* The export figures are those for the fiscal year ended June 30, 1916.

In 1916, the output amounted to 8,127,161 tons, a decrease of 1,321,847 tons as compared with 1915. The coal trade continued in a depressed condition throughout the year, more particularly in the northern district, which was affected by the limitations placed upon the export trade due to the war. Also, the general strike, which rendered the colleries idle from the end of October to the beginning of December, was responsible for a diminution of at least 700,000 tons in the year's production.

The output for 1917 showed an increase of 165,706 tons, compared with that of the previous year. During 1917, three collieries, with prospects of large production, began operations on the coal seams, viz., Pelton, owned by the Newcastle-Wallsend Coal Company, and the Aberdeen, South, and Central Mines, owned by the Caledonian Collieries, Limited. Sydney Harbour, Seaham, Killingworth and Duckenfield are four of the most important collieries which were idle during the greater part of the year.

In order to meet the special emergency created by the strike in 1917, and by the disruption of the ordinary system of supply, the Commonwealth Government, in agreement with the State, constituted a Coal Board to deal with coal supplies. Under the joint control of the Board and a State sub-committee, certain collieries were worked, and the available coal was apportioned and distributed. These operations ceased, after a few months, on the termination of the strike.

In 1918, again, an increase in production took place, amounting to 770,309 tons over the previous year. The foreign export (excluding bunkers) during the fiscal year 1917-18, was 355,955 tons compared with 2,097,097 tons for the calendar year 1913. The consumption of coal in the State increased from 4,182,441 tons in 1913 to 5,041,500 tons in 1918.

The average price per ton of the total output of the collieries throughout the State was 10*s*. 10·86*d*., compared with 7*s*. 2·89*d*. in 1913.

In 1919, there was a decrease of 431,622 tons in the production, compared with that of the previous year, and of 1,782,611 tons compared with that of 1913.

The Report of the Royal Commission appointed to enquire into the coal mining industry in the State of New South Wales (1919—p. 6) ascertained that the foreign trade in New South Wales coal was likely to experience some serious opposition to its re-establishment on a pre-war level, and to its further expansion, by reason of several factors, some of which were old, and some new. The practical extinction of the foreign export trade, as distinguished from the foreign bunkering trade, had produced and would continue to produce an appreciable effect on output, even if the foreign bunkering trade were restored, eventually, to its pre-war level. If the output were to reach a standard, commensurate with the magnitude of the State's resources and requirements, there would have to be a reduction of the price of the product, an increase of production, and a considerable development in the domestic market.

The production of coal in the State is obtained largely from Crown lands, held under mining leases, and yielding rent or royalty to the Crown—usually *6d.* per ton for large, and *3d.* per ton for small, which are the *maxima* in accordance with the terms of the leases granted under the authority of the Mining Act. The area of coal lands held under lease, at the end of 1919, amounted to 74,060 acres, while that of coal and shale lands amounted to 97,801 acres.

*Under the State Coal Mines Act, 1912, the Government opened a State Coal Mine at Lithgow, in the western district, in September, 1916, and operations were continued till July, 1917, when, as the result of the decision of the Cabinet, all work ceased. It was considered advisable to construct the railway, before operations were resumed.

†Deposits of lignite or brown coal, of limited extent, have been found in many of the goldfields, as at Kiandra, Gulgong, and Forest Reefs, near Milthorpe. No attempt has been made to utilize any of these deposits, as a source of fuel, and they cannot be considered as of any commercial importance. At Kiandra, a deposit of lignite with a maximum thickness of 30 feet was found, but, as a general rule, the seams vary from 1 foot to 3 feet in thickness.

COKE.

Coke-making is carried on in each of the three coal-mining districts of the State, but the bulk of the output comes from the southern district, where it is manufactured from coal drawn from the mines in the locality of Wollongong.

All the coke produced is suitable for use in blast furnaces, but that of the northern and southern districts is harder and contains less ash than that of the western. The coking-plants in the southern district are closer to Sydney than those in the northern and western districts and have the advantage, in railway transit, of a lower transport cost.

In 1913, the quantity of coke manufactured during the year amounted to 298,612 tons, an increase of 57,453 tons compared with that of the previous year.

The output would probably have been greater, but for the fact that all the coke-ovens on the south coast were idle for a period of eight weeks, owing to a stoppage of work through industrial troubles at the collieries in the southern district. In the northern district, the Australian Coking and By-product Company erected 48 ovens, constructed on the Collie and Otto principle, these being the first by-product ovens erected in the State.

In 1914, although there was an increase in coke-production of 6,188 tons, the coke trade was in a very unsettled condition, in consequence of the depressed metal market and the effects of the European war. The Australian Coking and By-product Company's ovens, as well as those of other companies, were idle during the greater part of the year.

*** Annual Report Department of Mines, 1917, p. 59.**

† Coal Resources of New South Wales, by E. F. Pittman, 1912, p. 4.

In 1915, there was an increased production of 112,953 tons, the bulk of the increase being about equally divided between the northern and southern districts, with a slight increase in the western. Early in the year, a bench of 66 Semet-Solvay by-product ovens was erected and completed by the Broken Hill Proprietary Company, at Port Waratah, and operations were begun, an addition being made at the end of the year.

In 1916, a large plant was laid down in the Illawarra District for the production of coke and for the recovery and utilization of the various by-products. The by-product plant at the Broken Hill Proprietary Iron and Steel Works at Newcastle was working satisfactorily.

In 1917, the production of coke amounted to 455,587 tons, an increase in quantity of 18,000 tons compared with that of the previous year, and a very material increase in the value of 6*s.* per ton.

In 1918, the production amounted to 608,492 tons, an increase of 152,905 tons, but the average selling price per ton was 2*s.* 5*d.* lower.

In 1919, there was a reduced demand for coke, for which the closing down of the copper mines was largely responsible.

*Approximate estimate of the available Coal Resources of New South Wales.**

	Productive Area.	Aggregate thickness of workable coal in the most productive areas.	Actual Reserve.				
			At depths less than 4,000 feet.			At depths between 4,000 and 6,000 ft.	
			Thickness.	Area.	Quantity of Coal.	Area.	Quantity of Coal.
	Square Miles.	Feet.	Feet.	Square Miles.	Millions of Tons.	Square Miles.	Millions of Tons.
Upper and Middle Coal Measures	15,800	58	10	16,708	117,240	(No data.)†	
Greta Coal Measures (Northern district)	250	20				100‡	1,200
Greta Coal Measures (Southern district)	500						
Total ...	16,550	78	10	16,708	117,240	100	1,200

* Coal Resources of the World, 1913, Vol. I, p. 11 ; Coal Resources of New South Wales, by E. F. Pittman, 1912, pp. 23, 24.

† No estimate can be attempted of the quantity of coal obtainable from the Upper and Middle Coal Measures, between 4,000 and 6,000 feet in depth, as necessary data are not obtainable.

‡ This area is in the vicinity of Kurri Kurri and Cessnock, south of the Hunter river.

Table of Analyses of New South Wales Coals.*

Locality.	Proximate Analysis.					Evaporative power.	Authority.
	Fixed carbon.	Volatile hydrocarbons.	Moisture.	Ash.	Sulphur.		
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	lb.	
Greta Coalfield—							
Greta mine	54·41	39·21	2·25	1·41	Not determined.		Liversidge.
Newcastle Coalfield—							
Aust. Agr. Co....	57·52	33·60	2·20	5·35	1·33		"
Minmi	56·49	33·87	2·59	5·61	1·44		"
Glebe	59·16	33·36	2·14	4·76	0·58		"
New Lambton	59·56	30·62	2·61	6·72	0·49		"
Wallsend	57·22	34·17	2·75	4·64	1·22		"
Waratah	55·82	36·70	2·21	4·15	1·12		"
Upper or Newcastle Coal Measures—average of 78 samples.	53·27	36·01	2·01	8·71	[0·47]	12·7	Geological Survey Laboratory.
Middle or Tomago Coal Measures—average of 5 samples.	52·77	35·71	1·88	9·64	[1·18]	12·5	" " "
Lower or Greta Coal Measures—average of 51 samples.	49·52	41·61	1·84	7·03	[1·29]	13·07	" " "
Lower or Greta Coal Measures—average of 31 samples as actually worked.	50·51	41·35	1·89	6·25	[1·01]	13·2	" " "
Lake Macquarie—							
Lake Macquarie	49·48	43·36	1·85	4·96	0·35		Liversidge.
" "	54·66	31·93	3·65	8·82	0·94		"
" "	53·88	31·95	2·31	11·12	0·74		"
Redhead	57·04	33·48	2·09	6·84	0·55		"

Table of Analyses of New South Wales Coals—continued.

Locality.	Proximate Analysis.					Evaporative power.	Authority.
	Fixed Carbon.	Volatile hydro-carbons.	Moisture.	Ash.	Sulphur.		
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	lb.	
Illawarra Coalfield—							
Bulli	61·61	23·65	1·03	13·17	0·54		Liversidge.
"	65·68	21·65	0·65	11·28	0·74		"
Coal Cliff	69·84	18·22	0·86	10·80	0·28		"
Mount Kembla	67·18	19·74	1·50	10·72	0·86		"
Mount Pleasant	68·08	22·04	0·70	8·76	0·42		"
Southern District—							
Berrima	62·28	26·61	1·26	9·40	0·45		Dixon. Extra good sample.
Wingello	58·60	24·87	1·96	14·04	0·53		Dixon.
Upper Coal Measures in the Southern Coalfield—average of 35 samples.	63·98	23·65	0·71	11·66	[0·47]	12·68	Geological Survey Laboratory.
Sydney Harbour	70·17	19·25	0·35	10·23	[0.23]	12·70	" "
Mountain (or Western) Coalfield—							
Lithgow Valley Coal Company ...	52·34	34·18	1·95	10·12	1·41		Liversidge.
" " " " ...	58·80	28·48	2·24	9·68	0·80		"
Eskbank Coal Company	57·88	28·78	2·70	9·88	0·76		,
" " "	49·97	33·55	2·00	12·91	1·57		"
Vale of Clwydd	52·36	35·02	2·15	9·78	0·75		"
" "	53·38	33·35	2·10	9·80	1·37		"
Upper Coal Measures in the Western Coalfield—average of 25 samples.	53·08	32·31	2·05	12·56	[0·67]	11·9	Geological Survey Laboratory.

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* Trans. Inst. of Mining Engineers (London), Vol. II, 1890–91, pp. 324–25. Coal Resources of New South Wales, Geological Survey of New South Wales, E. F. Pittman, 1912.

Production of Coal in New South Wales.

Year.	Quantity (long tons).	Value at Pit's mouth.	Average per ton.	
		£	*s.*	*d.*
1913	10,414,165	3,770,375	7	2·89
1914	10,390,622	3,737,761	7	2·17
1915	9,449,008	3,424,650	7	2·98
1916	8,127,161	3,336,419	8	2·00
1917	8,292,867	4,422,740	10	8·00
1918	9,063,176	4,941,807	10	10·86
1919	8,631,554	5,422,846	12	6·00

Particulars of Coal cut by Machinery in New South Wales.

Year.	Class of machine.					Motive power.		Long tons of mineral obtained.		
	Disc.	Percussive.	Revolving Bar.	Chain-Breast.	Total.	Electricity.	Compressed Air.	By Electricity.	By Compressed Air.	Total.
1913	—	80	6	147	233	153	80	2,203,265	633,451	2,836,716
1914	—	83	—	160	243	163	80	2,264,010	511,911	2,775,921
1915	—	100	—	172	272	172	100	2,162,726	654,346	2,817,072
1916	—	139	1	172	312	173	139	1,797,066	653,205	2,450,271
1917	—	94	—	179	273	179	94	1,822,897	486,289	2,309,186
1918	—	105	—	176	281	176	105	1,846,101	659,889	2,505,990
1919	—	104	—	178	282	178	104	1,812,558	611,213	2,423,771

Disposal of Coal produced in New South Wales.

(Inclusive of bunker coal, both foreign and inter-state.)

Year.	Exports to Australian Ports.		Exports to other Ports.		Total Exports.		Home consumption (long tons).
	Quantity (long tons).	Value at port of shipment	Quantity (long tons).	Value at port of shipment.	Quantity (long tons).	Value at port of shipment.	
		£		£		£	
1913...	3,465,787	1,820,823	2,765,937	1,521,180	6,231,724	3,342,003	4,182,441
1914...	3,221,783	1,695,271	2,646,250	1,463,880	5,868,033	3,159,151	4,522,589
1915...	2,601,070	1,356,726	2,067,324	1,128,722	4,668,394	2,485,448	4,780,614
1916...	2,203,659	1,145,787	1,230,439	727,511	3,434,098	1,873,298	4,693,063
1917...	2,225,228	1,590,579	1,038,569	793,292	3,263,797	2,383,871	5,029,070
1918...	2,697,033	1,974,675	724,643	550,323	3,421,676	2,524,998	5,641,500
1919...	1,891,317	1,536,039	1,611,701	1,383,059	3,503,018	2,919,098	5,128,536

Production of Coke at Coke Ovens in New South Wales.

Year.	Quantity (long tons).	Value at Ovens.	
		Total.	Per ton.
		£	£ s. d.
1913	298,612	208,989	0 14 0
1914	304,800	213,069	0 13 11
1915	417,753	313,241	0 14 11
1916	437,587	387,571	0 17 9
1917	455,587	541,093	1 3 9
1918	608,492	647,798	1 1 4
1919	424,773	550,127	1 5 11

Particulars of Coke Ovens in New South Wales.

Year.	Coke Ovens.				
	Number at work.	Number built but not working.	Number of ovens in course of building.	Total number of ovens built and in course of building.	Persons engaged in manufacture of coke.
1913 ...	768	192	6	966	446
1914 ...	725	280	—	1,005	442
1915 ...	833	218	58	1,109	639
1916 ...	884	203	22	1,109	599
1917 ...	844	286	103	1,233	658
1918 ...	861	316	57	1,234	664
1919 ...	821	307	29	1,157	515

Victoria.

*Deposits of bituminous coal, of Jurassic age, are found in Victoria, and all the workable seams, which range from 2 feet 3 inches to 6 feet in thickness, are in the southern Gippsland district. The largest output is obtained at the State Mines, Wonthaggi, which, in 1918, produced 389,794 tons out of a total for the State of 439,575 tons (bituminous coal only). The coal is a good steaming and domestic fuel, and gives off comparatively little smoke.

Extensive deposits of brown coal and lignite, of Tertiary age, occur throughout Gippsland, Mornington Peninsula, Werribee Plains, Gellibrand, and Barwon and Moorabool basins. In the Latrobe Valley the beds reach a thickness of over 800 feet.

In 1917, an Advisory Committee, appointed to report on the brown-coal deposits of Victoria, recommended the establishment of an open-cut mine at Morwell, in connection with a comprehensive scheme for electrical power generation and transmission, as well as for the supply of brown coal for other requirements.

Large deposits of brown coal occur at Altona, quite close to Melbourne, but the coal would have to be got by tunnelling, whereas that at Morwell, although 80 miles from Melbourne, has the advantage of being workable by quarrying or open-cut.

The output of coal during 1913 was 593,913 tons, of which 486,238 tons were produced at the State coal mine at Wonthaggi. Brown coal, to the extent of 2,984 tons, was raised at Altona.

Boring operations were carried on during 1913 in the Morwell and South Gippsland brown-coal areas. As only thin seams were proved, and as there was a great thickness of overburden, the latter area appeared to be of doubtful commercial value at that time.

In 1914, there was an increase of 23,354 tons in the total production of bituminous coal and brown coal, compared with that of the previous year. The output of the State mine increased to about 2,300 tons per day. Electrical coal-cutters were employed extensively, and electricity was utilized as much as possible for power and lighting purposes.

Two drills were in operation throughout the year, proving the ground ahead of the workings, a policy which has given highly economical and satisfactory results.

In 1915, there was a decrease of 29,283 tons in the total output compared with that of the previous year.

In 1916, there was a further fall of 170,870 tons in the total production compared with that of the previous year, the value at the pit's mouth being 10*s*. 4*d*. per ton, an increase of 1*s*. 0·2*d*. per ton, or of 1*s*. 1·4*d*., compared with 1913. The rapidly increasing cost of bituminous coal concentrated public interest during the latter half of the year on the problem of the utilization of brown coal, and a sub-committee on brown coal was appointed by the Institute of Victorian Industries. Boring operations in the brown-coal areas were resumed in April between Yarrowgon and Trafalgar.

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* Official Year Book of the Commonwealth of Australia, No. 13, 1920, p. 469.

In 1917, there was an increase in the total production of 81,058 tons, compared with that of the previous year. Owing to the scarcity of bituminous coal, due to strikes at the mines of New South Wales, the brown-coal mine at Morwell was developed by the State Department, and 34,936 tons were produced.

In 1918, the total production amounted to 505,734 tons, being an increase of 4,578 tons compared with that of the previous year (and a decrease of 91,122 tons compared with the year 1913), and an increase, in the average value, of 5*s*. 3*d*. per ton, compared with 1913. About 89 per cent. of the bituminous coal was produced at the State coal mine at Wonthaggi, and about 94 per cent. of the brown coal at the State mine at Morwell. The State mine at Morwell produced 66,200 tons of brown coal during the year, in order to meet the very large demand brought about by the continued shortage of supplies from New South Wales, owing to the strike of seamen.

In 1919, the total production of coal amounted to 535,574 tons, being an increase of 29,799 tons compared with that of 1918. This net increase was made up by an increase of 45,428 tons in the production of brown coal, and a decrease of 15,629 tons in the production of bituminous coal.

PATENT FUEL.

*Attempts have been made to manufacture briquettes from brown coal, but so far without any great measure of success.

Coal Resources of Victoria.†

(Bituminous Coal).

District.	Including Seams of 1 foot or over, to a depth of 4,000 feet.				Including Seams of 2 feet and over, at depths between 4,000 and 6,000 feet.			
	Coal Seams.	Actual Reserve (calculation based on actual thickness and extent).		Probable Reserve.	Actual Reserve (calculation based on actual thickness and extent).		Probable Reserve (approx. estimate).	
	Thickness.	Area (sq. miles).	Tons.		Area (sq. miles).	Tons.	Area (sq. miles).	Tons.
Gippsland	1′ to 1′ 9″	12	15,000,000	Impossible to estimate even approximately.				
"	2′ to 9″				6	25 000,000	5	12,000,000
Otway ...	1′ to 1′ 6″	½	100,000					
Merino ...	1′ to 1′ 3″	¼	50,000					

The data are insufficient to form any estimate of the possible reserves.

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* Official Year Book of the Commonwealth of Australia, 1901–1917, p. 461.

† Coal Resources of the World, Vol. 1, 1913, p. 15.

*Analyses of Victoria Coals.**

—	Proximate analysis.			
	Moisture.	Fixed carbon.	Volatile hydro-carbons.	Ash.
	Per cent.	Per cent.	Per cent.	Per cent.
Gippsland Area, Korumburra Coal Creek	7·90	57·17	28·78	6·14
Morwell (Lignite) ...	25·58	39·06	32·14	2·30

* Coal Resources of the World, 1913, Vol. 1, p. xlii.

Production of Coal in Victoria.

Year.	Bituminous Coal		Brown Coal.		Total.	
	(long tons).	(£)	(long tons).	(£)	(long tons).	(£)
1913 ...	593,913	274,371	2,984	569	596,897	274,940
1914 ...	617,536	288,535	2,715	564	620,251	289,099
1915 ...	588,104	274,770	2,864	573	590,968	275,343
1916 ...	417,183	216,292	2,915	583	420,098	216,875
1917 ...	466,220	335,259	34,936	9,607	501,156	344,866
1918 ...	439,574	349,696	66,160	17,920	505,734	367,616
1919 ...	423,946	372,075	111,628	34,542	535,574	406,617

Production of Coal from State Mines in Victoria.

(This production is included in the Table given above.)

Name of Mine.	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Wonthaggi (bituminous coal)	486,238	550,107	528,922	354,146	405,498	389,794	361,872
Morwell (brown coal)	—	—	—	—	34,936*	62,517	110,183
Total	486,238	550,107	528,922	354,146	440,434	452,311	472,055
	Value (£).						
Wonthaggi (bituminous coal)	211,423	247,548	238,015	173,839	283,848	302,311	
Morwell (brown coal)	—	—	—	—	9,607	17,192	
Total	211,423	247,548	238,015	173,839	293,455	319,503	

* Developed by State, owing to shortage of bituminous coal due to strikes.

Queensland.*

Queensland possesses coal deposits of three ages:—Upper Cretaceous, Trias-Jurassic, and Permo-Carboniferous. The Cretaceous fields are situated in the central part of the State, and the Trias-Jurassic and Permo-Carboniferous fields in the south-eastern part. Most of the coal production is, at present, obtained from the Trias-Jurassic measures. The productive coal districts and the output of each, in 1918, are shown in the following Table:—

District.	Coal Production in 1918 (long tons).
1. Chillagoe (Mount Mulligan) ...	16,305
2. Clermont	122,812
3. Darling Downs	94,242
4. Ipswich	678,931
5. Rockhampton (Central)	7,955
6. Wide Bay and Maryborough ...	62,948
Total	983,193

†Of these districts, the Ipswich and Walloon, and Darling Downs (Toowoomba and Warwick) districts (Nos. 3 and 4) are situated in the south-east corner of Queensland, in the neighbourhood of Brisbane, and the coal worked is of Trias-Jurassic age. In the Ipswich area the seams vary much in thickness within short distances, and the coal is inclined to be friable, although excellent for steaming and—in one portion of the field—for coke-making. The Walloon coals are very firm and specially in demand for gas-making. In the Toowoomba area, the coal seams are being vigorously worked. The coal is very firm, and while good for steaming purposes, is specially good for gas-making. In the Warwick area, the coal is gaseous, like all the Darling Downs coals; nevertheless, it is in demand for locomotive fuel.

In the Wide Bay (Maryborough and Burrum) district (No. 6), coal of Trias-Jurassic age is worked. There are several seams of coal, having first-class steaming and coking qualities.

In the Rockhampton (Bluff, Blackwater and Styx) district (No. 5), the coal worked is of Permo-Carboniferous age.

The Clermont (Blair Athol) district (No. 2), is about 250 miles inland from Rockhampton. Two seams of coal, of Permo-Carboniferous age, are being worked. The top seam, 4 ft. thick, is bright and of fine quality; the lower seam, 66 ft. thick, is rather dull, but excellent for steaming purposes. Neither coal is suitable for coking.

The Chillagoe (Mount Mulligan) district (No. 1), is about 120 miles west of Cairns, and is the most northerly coal area that is being worked in the State. The coal is of Permo-Carboniferous age.

The only known area of brown-coal deposit in Queensland is situate at Waterpark Creek. The bed is about 52 feet in thickness, and the quality is good, but no attempt has yet been made to develop it.

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* Annual Reports of the Under Secretary for Mines, Queensland.

† Coal Resources of Queensland; B. Dunstan, 1913.

In 1913, there was a total output of 1,037,944 tons of coal, more than half of which was obtained from collieries in the Ipswich district. About 100,000 tons of coal and 50,000 to 60,000 tons of coke are imported from New South Wales every year. During the year, 1,986 tons of coke were landed at Rockhampton from Germany.

Following the discovery of the extension of the Aberdare seam, the Ipswich city colliery commenced operations, and the machinery and equipment of a number of other collieries was improved during the year.

On the Darling Downs, two new collieries commenced operations.

In 1916, there was a decrease in the production of coal of 116,546 tons compared with that of the previous year, and of 130,217 tons compared with that of 1913, attributable, chiefly, to the cessation of operations during an industrial dispute towards the end of the year, although in the Clermont and Mount Mulligan districts there was an increased output. During the year, the Government carried out considerable development work at the State coal mine at Warra and conducted extensive boring operations on the Bowen River Coalfield.

In the Maryborough and Burrum districts the coal trade was adversely affected by the unsettled conditions regarding the selling price to the railway company—the principal customer.

In 1917, there was an increase of production of 140,746 tons compared with that of the previous year, and the average value, at the pit's mouth, was 2*s.* 9·8*d.* per ton higher. The increased output of coal is accounted for by the general improvement of trade, and was derived chiefly from some of the principal collieries in the Ipswich district. A quantity of graded coal from Blair Athol field was shipped to a northern port during the year, which may lead to an increased output.

In 1918, 983,193 tons of coal were produced, showing a decrease of 65,280 tons compared with the previous year, and of 54,751 tons compared with 1913. The output of the Darling Downs field is almost entirely supplied to the railway department, and the decrease from this field was probably the result of a curtailed railway service. The decrease from the Blair Athol field was entirely due to slackness of trade.

Production of Coal from State Mines in Queensland.

*In 1918, the State coal mine at Warra produced 11,477 tons of coal, which were consumed for railway purposes on the Darling Downs. This was the first production reported. In 1919, the mine was closed down, owing to the thinness of the seam, the deterioration in the quality of the coal, and water difficulties.

*A site for the State coal mine on the Bowen coalfield had been selected, but extensive operations had not started in 1918.

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* **Annual Report of Under Secretary for Mines, 1918, p. 133.**

Coal Resources of Queensland *

(in millions of tons).

District.	Seams.		Actual Reserve. (Calculation based on actual thickness and extent.)		Probable Reserve. (Approximate Estimate.)			Possible Reserve.
	No.	Aggregate Thickness.	Area.	Quantity.	Area Sq. miles.	Class of Coal.	Quantity.	Quantity.
1. Beaudesert Group ...	7	31′ 4″	—	—	1	Bituminous	31·4	90
2. Burrum Group	31	76′ 8″	40 to 80 acres	1·7	½ to 2		103·6	284
3. Callide Creek	1	21′	1 sq. mile	20	5		100	500
4. Chincilla Area	7	40′	—	—	½		20	100
5. Clermont Area	2	69′	2 to 3 sq. miles	208	3–5		313	1,013
6. Cooktown Field	1	1′ 3″	—	—	2		2·8	140
7. Dalby Area	3	14′ 2″	80 acres	1·9	2		30	60
8. Dawson River	4	28′	60 acres to ½ sq. mile	9·3	½ to 4	Anthracitic	69·8	460
9. Hughenden Area... ...	2	2′ 3″	—	—	1	Bituminous	4	11
10 Ipswich Area	8–10	42′ 2″ to 57′ 6″	⅛ to 1 sq. mile	31·04	¼ to 4		207·4	2,404
11. Walloon	3	13′	⅛ sq. mile	1·82	2 to 4		44·4	364
12. Little River	3	1′ 9″	3 acres	·01	1		2	8
13. Mackenzie River, Central Rail Area	4	36′ 9″	80 acres to 5 sq. miles	113·6	1 to 40		543	6,265
14. Mount Mulligan	2	7′	2 sq. miles	15	8		60	150
15. Nebo Area	1	4′ 6″	—	—	4	Anthracitic	20	100
16. Nundah, Eagle Farm ...	1	3′	80 acres	·4	5	Bituminous	10	30
17. Styx River	5	8′ 3″	160 acres	2·7	1		8	120
18. Tiaro Area	7	23′ 8″	—	—	½ to 1		20	86
19. Toowoomba Area ...	9	31′	40 to 80 acres	2·1	½		16·8	50
20. Warwick Area	9	28′ 3″	80 acres	1·95	½		14·8	87
21. Waterpark Creek... ...	2	57′ 6″	26 acres	2·6	1	Brown coal	64	800
TOTALS				412·.2			1,685	13,122

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* Coal Resources of the World, 1913, vol. I, pp. 35–37.

Analyses of Coals from the Queensland Coalfields. *

Locality.	Proximate Analysis.			Authority.
	Fixed Carbon.	Volatile Hydro-carbons and Moisture.	Ash.	
Thomas Mine, Bundambe	59·20	29·80	11·00	A. C. Gregory,
Jones Mine, Ipswich ...	61·50	28·90	9·60	"
Waterstown Mine, Ipswich	62·00	25·20	12·80	"
Tivoli Mine, Ipswich ...	66·40	26·70	6·90	"
Walloon Mine, Moreton ...	42·00	41·00	17·00	"
Burrum Mine, Maryborough	64·00	31·50	4·50	"

* Trans. Inst. Min. Eng. (London), vol. II., p. 324.

Production of Coal in Queensland.

Year.	Screened (long tons).	Unscreened (long tons).	Small (long tons).	Total (long tons).
1913	330,981	606,006	100,957	1,037,944
1914	280,900	648,662	124,428	1,053,990
1915	333,847	564,952	125,474	1,024,273
1916	293,333	510,167	104,227	907,727
1917	333,735	586,773	127,965	1,048,473
1918	360,769	492,175	130,249	983,193
1919	368,104	414,339	149,188	931,631

Average Value of Coal in Queensland.

Year.	Average Value per ton at Pit's Mouth.
1913	7*s*. 9·3*d*.
1914	7*s*. 10·8*d*.
1915	7*s*. 11·9*d*.
1916	8*s*. 6·9*d*.
1917	11*s*. 4·74*d*.
1918	11*s*. 7·7*d*.
1919	13*s*. 2·2*d*.

Production of Coke in Queensland.

Year.	Quantity (long tons).
1913	14,942
1914	16,685
1915	17,085
1916	17,904
1917	13,399
1918	14,437
1919	4,562

Western Australia.

The Collie coalfield is the only area in Western Australia where marketable coal has been proved to occur, although there are districts in the State where lignite and brown coal are found.

The area occupied by the coal measures is, approximately, 50 square miles, and there are several coal seams, which are of variable thickness, the thickest being the Wallsend seam, which varies from 9 to 17 feet. According to estimates, and omitting thin seams, there is a thickness of about 137 feet of coal in the 2,072 feet of strata so far explored by mining and boring operations. The coal workings are very shallow.

The coal is bituminous, non-caking, and, in some places, approaches very closely to lignite.

* The average calorific value of the Collie coal is about 10,000 B.Th.U., and is lower than that of New South Wales. Being non-caking, it crumbles in the furnaces, and requires close attention in firing. The coal from some of the seams is subject to spontaneous combustion. The Collie coal, although not of the best steam-producing quality when burned in ordinary boiler furnaces, has been proved to be particularly suitable for use in suction gas producers, on account of its singular deficiency in volatile matter.

The principal local consumers are the Government railways and industries; the goldfields market for coal is limited by the good supplies of firewood which are available.

In the Kimberley division, in the extreme north of Western Australia, a seam of bituminous, non-caking coal, somewhat similar to that occurring at Collie, has recently been found in well-sinking, on Lower Liveringa Station, some distance to the south of Derby, in the valley of the Fitzroy river. The seam, which proved to be twelve feet thick, was met with at a depth of fifty feet from the surface, in strata which seem likely to be of Upper Carboniferous age.

In 1913, six collieries were working on the Collie field, and the output for that year was 313,818 tons, an increase of 18,739 tons compared with the previous year, attributable to the installation of better plant and machinery, improved conditions generally, reduction in the price of coal, and the establishment of a bunkering trade at Bunbury and Fremantle. This increase was maintained throughout 1914.

In 1915, there was a decrease of 32,544 tons, largely attributable to a lower activity at the Scottish collieries, owing to an inflow of water, the company eventually finding it necessary to open out a new mine, after carrying out a series of borings in order

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* Western Australia Geological Survey Bulletin No. 64, 1915, p. 105; Western Australia Geological Survey Memoir No. 1, Pt. II, Sec. 1, 1919, The Coal Deposits of Western Australia.

to prove the property further. This new mine began production in 1918, but many difficulties were encountered, and work was considerably retarded. There was also a falling off in the bunkering trade.

In 1916, with the exception of the Scottish collieries, the mines were actively worked, and there was an increase in the output of 14,860 tons, above the previous year.

In 1917, the production was 326,550 tons, the largest on record, showing an increase of 25,024 tons above the previous year.

In 1918, there was a further increase of 10,489 tons, above the previous year, or an increase of 23,221 tons above the production of 1913. Most of the mines were actively worked, excepting the Co-operative, where a heavy fall of ground occurred and stopped operations.

*What appears to be an extension of the Collie coalfield occurs on the upper reaches of the Collie River, about 5½ miles to the north-east of Wilga Siding on the Donnybrook-Preston Valley Railway. Several prospecting shafts were put down in the area, the deepest vertical shaft being about 125 feet from the surface. and several seams of coal have been met with. The extent of the area has not been ascertained, although there is very little doubt that the beds accompanying the coal belong to the Collie River Series, and that the seams make a considerable addition to the coal reserves of that formation. The deposit, at a point 5 miles south-west of Wilga, is described as a thin-bedded coal of the hydrous bituminous class, similar in all respects to that found in the lower parts of the Collie basin. It loses moisture rapidly on exposure to the air, increasing thereby in calorific value, but losing cohesion to a large extent. It does not cake when retorted.

Coal Resources of Western Australia.†

Including seams of 1 Foot or over, to a depth of 4,000 feet.

District.	Coal Seams.	Actual Reserve. (Calculation based on actual thickness and extent.)			Probable Reserve. (Approximate estimate.)	
	Thickness.	Area.	Class of Coal.	Tons.	Area.	Tons.
Collie...	3 ft. to 17 ft.	5,760 acres	Bituminous	153,331,200	61,440 acres.	500,000,000

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* Western Australia Geological Survey Memoir No. 1, Pt. II, Sec. 1, 1919, The Coal Deposits of Western Australia.

† Coal Resources of the World, 1913, Vol. 1, p. 70.

Analyses of Coals of Western Australia.[*]

Locality.	Specific Gravity.	Proximate Analysis.				Ultimate Analysis.							Calorific Value.
		Moisture.	Fixed Carbon.	Volatile Hydro-carbons.	Ash.	Moisture.	Carbon.	Hyrogen.	Oxygen.	Nitrogen.	Sulphur.	Ash.	
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	B.Th.U.
Collie Coalfield ...	1·34	21·18	43·73	28·99	6·10	21·18	54·93	3·10	12·82	1·04	0·53	6·10	9,637†
Kimberley (Lower Liveringa Station)		8·87	33·99	29·73	27·41								
Liveringa Station ...		11·71	36·92	37·81	13·56								

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[*] Coal Resources of the World, 1913, Vol. I., pp. 68–70.

† Calculated calorific value of dry coal, 12,231 B.Th.U.

Production of Coal in Western Australia.

Year.	Quantity Raised (long tons).	Estimated Value. (£)
1913	313,818	153,614
1914	319,210	148,684
1915	286,666	137,859
1916	301,526	147,823
1917	326,550	191,822
1918	337,039	204,319
1919	401,713	270,355

Coal entered for Export, Western Australia.

—	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Bunker Coal	54,228	54,416	26,167	37,590	31,951	23,238	69,708
Coal for Export ...	—	—	1,667	2,447	—	—	—
TOTAL	54,228	54,416	27,834	40,037	31,951	23,238	69,708
	Value (£).						
Bunker Coal	39,125	38,244	19,288	28,387	29,359	24,424	76,924
Coal for Export ...	—	—	1,513	1,857	—	—	—
TOTAL	39,125	38,244	20,801	30,244	29,359	24,424	76,924

Tasmania.

* Coal is found in Tasmania in strata of three geological periods: Permo-Carboniferous (lower coal-measures of Tasmania); Mesozoic (upper coal-measures of Tasmania), probably Triassic or Trias-Rhætic; and Tertiary (brown coal and lignitic deposits).

The Permo-Carboniferous coal areas, with one notable exception, are situated in the north-west and north of Tasmania—the exception being the Mount Cygnet and Bruni Island coalfield, which lies in the extreme south-east. A seam of brown oil-shale (tasmanite shale) occurs at various points in the basins of the Don and Mersey Rivers. Its thickness varies from four to seven feet. It consists of shale impregnated with globules of a resinous substance, known as tasmanite. This burns readily with a smoky flame and unpleasant odour, and, when submitted to destructive distillation, yields a variety of oils suitable for illuminating, lubricating and fuel purposes. Working tests have established that from 40 to 50 gallons of crude oil per ton can be extracted from it, and it is believed that the deposits are of great value as a source of supply of fuel oil for steamers. The probable area of the seam is 2,000 acres, and its contents are estimated at 12,000,000 tons of shale.

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* Coal Resources of the World, 1913, Vol. 1.

The Mesozoic coal areas are mostly in the west, though in a few cases they are associated with Permo-Carboniferous coal-fields in the north-west.

The Tertiary lignite and brown coal deposits are widely distributed, but, at present, their economic value is only potential.

*In 1918, 94 per cent. of the total coal production of Tasmania, which amounted to 60,163 tons, was raised by the Mount Nicholas Coal Company, Limited, and the Cornwall Coal Company, from mines working Mesozoic coal on the southern flank of the range between the townships of Fingal and St. Mary. Six or seven seams are known to occur, varying in thickness from 3 to 10 feet, each seam covering from 200 to 1,500 acres. Analyses made by the Government gave the following average result :—

	Per cent.
Moisture	6·18
Fixed carbon	57·61
Volatile matter	27·06
Ash	9·15
	100·00
Sulphur	0·55

In 1918 the Mount Nicholas Coal Company, Limited, were working a 6-feet seam, and were opening out a 4-feet seam. The total output from the mine was 29,403 tons. The Cornwall Coal Company were working the 6-feet seam, and their total output was 26,900 tons.

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* Report of the Secretary for Mines, Tasmania, for 1918. Coal Resources of the World, 1913, Vol. 1.

*Coal Resources of Tasmania.**

District.	Including seams of 1 ft. or over, to a depth of 4,000 ft.				
	Coal seams.		Probable reserve. (Approximate estimate.)		Possible reserve.
	Thickness.	Area.	Class of coal.	Tons.	
Mesozoic coal :—					
Mount Rex	12 ft.	40 acres	Bituminous	500,000	
Rigney's	10 ft.	140 acres	„	1,500,000	Moderate.
St. Paul's			„		
Mount Nicholas Range and Fingal	3 to 10 ft.	200 to 1,500 acres each seam.	„	25,000,000	Large.
Thompson's Marshes	Aggregate 8 ft.	600 acres	„	5,000,000	
Llandaff Seymour ...	Aggregate 2 ft.	1,800 acres	„	4,000,000	
York Plains	3 ft. and 2 ft.	200 acres	„	500,000	
Mike Howe's Marsh...	3½ ft.	Unknown			
Longford and Deloraine.	3 to 4 ft.	Unknown			
Colebrook	3 ft.	300 acres	„	2,000,000	
Schouten Island ...	4 ft.	100 acres	„	400,000	
Spring Bay	5 ft.	250 acres	„	900,000	Moderate.
Prosser's Plains ...	4 ft.	?			
Compton	2 ft.	?			
Lawrenny-Langloh...	3 to 4 ft.	200 acres	„	1,000,000	Moderate.
Sandfly	9 ft.	500 acres	„	4,000,000	Considerable.
Ida Bay	3 to 4½ ft.	500 acres	„	4,000,000	Considerable.
Recherche and Catamaran	Up to 7 ft.	1,000 acres	„	6,000,000	
Total Mesozoic coal	... ...	... ...	... ...	54,800,000	Sp. gr. 1·3 ; B.Th.U. 12,096.
Permo-carboniferous coal :—					
Preolenna	20 in. to 3 ft.	600 acres	Bituminous	3,000,000	
Barn Bluff	8 in. to 1 ft.	1,800 acres	Cannel	1,500,000	
Mount Pelion ...	2 ft.	600 acres	Bituminous	1,500,000	
Mount Cygnet ...	3 ft.	1,200 acres	„	3,000,000	Sp. gr. 1·35 ; B.Th.U. 12,492.
Bruni Island... ...	2 ft.	500 acres	„	1,000,000	
Mersey and Don ...	20 in.	600 acres	„	1,000,000	
Total Permo-Carboniferous coal	... ...	... ...	... ...	11,000,000	Unknown reserves fringing the Central Tiers.
TOTAL	... ...	... ...	... ...	65,800,000	

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* Coal Resources of the World, 1913, Vol. I, p. 62.

Analyses of Tasmanian Coal.[*]

Locality.	Proximate Analysis.					Analyst.
	Moisture.	Fixed carbon.	Volatile Hydrocarbons.	Sulphur.	Ash.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Sandfly ranges (18 in. seam)	5·00	62·20	23·30	0·80	8·70	D. Lewald
„ „ (28 in. seam)	5·30	63·50	15·70	0·80	14·70	"
„ „ (4 ft. seam)	5·40	67·00	12·70	0·60	14·30	"
Gardeners Bay	2·90	63·50	15·70		17·90	"
Enterprise Mine	3·70	53·10	13·90		29·30	"
Adventure Bay	3·00	69·90	14·20		12·90	"
Black Diamond	4·10	58·40	16·40		21·10	"
Jerusalem	2·80	56·80	12·50		27·90	"
Green Port, Mount Cygnet	1·20	64·80	19·90		14·10	"

[*] Trans. Inst. Min. Eng., Vol. II, p. 324.

Production of Coal in Tasmania.

Year.	Quantity (long tons).	Value at Pit's Mouth (£).
1913	55,043	25,367
1914	60,794	27,853
1915	64,536	30,418
1916	55,575	27,736
1917	63,412	38,673
1918	60,163	37,676
1919	66,253	47,004

Papua.

According to a report on the Purari coal seams by the Assistant Government Geologist, the coal is of Tertiary age and lignitic in character. The thickest seam examined was 2 feet 9 inches. Coal occurs also in the vicinity of the Kikori river.

NEW ZEALAND.[*]

Coal, varying in grade from anthracite to lignite, occurs in many parts of New Zealand. The quantity of proved bituminous coal has been found by exploration to amount to over 37 per cent. of the total, but the chief fuel reserve of the Dominion (excluding possible oilfields) lies in its brown coal.[†]

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[*] Mines Statements (Annual). Statistics of the Dominion of New Zealand, Vol. II, Trade and Shipping (Annual).

[†] Coal Resources of the World, 1913, Vol. I, p. 72.

The following is an estimate, by the Director of the Geological Survey of New Zealand, of the proved and probable coal resources, in millions of tons.

—	Proved.	Probable (including proved).	Possible.
Anthracitic coal	Very little	Very little	Small
Bituminous coal	187	477	Moderate
Pitch coal	68	196	Moderate
Brown coal	194	728	Large
Lignite...	161	420	Large
Totals	610	1,821	

At one time, a large percentage of the coal used in New Zealand was imported, chiefly from Australia, but the importation is now less than one-tenth of the total consumption.

The following table shows the output of coal from each coalfield :—

	Name of Coalfield.	Output during 1919 (long tons).
Coal ...	North Auckland	115,390
Lignite ...	Waikato (including Mokau)	396,061
Do. ...	Nelson	12,037
Coal ...	Buller	506,314
Lignite ...	Inangahua	20,006
Coal ...	Greymouth	307,469
Lignite ...	Canterbury	36,004
Do. ...	Otago	285,040
Do. ...	Southland	169,527
	Total	1,847,848

The production of coal in New Zealand during 1913 (including brown coal and lignite) amounted to 1,888,005 tons, a decrease of 289,610 tons compared with that of the previous year. This decrease was due to a general strike, which caused nearly every colliery of importance to be closed during the months of November and December. The resulting shortage of coal was made good by importation. It amounted to 468,940 tons, the greatest quantity ever imported, being 104,581 tons in excess of that in 1912. During the year, the new Liverpool State colliery, near Point Elizabeth, entered the producing stage.

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* New Zealand Official Year Book, 1919, p. 590.

In 1914, there was an increase of production of 387,588 tons, compared with that of the previous year, the principal activity being in the Westport, Greymouth and Waikato districts. The only new colliery of importance opened during the year, was that of the Waipa Company, of Glen Massey, near Ngaruawahia. The new mine of the Pukemiro Collieries, Limited, in the same locality, had not reached the productive stage. A new seam of superior bituminous coal (the Morgan seam), 17 feet thick, was discovered at the State Liverpool Colliery, in the valley of Seven Mile Creek, by boring operations.

In 1915 and 1916, the principal activity was in the Westport. Greymouth and Huntly districts. In 1915, considerable developments took place in the Westport Coal Company's Denniston and Millerton collieries, where large areas of hard bituminous coal of the best quality were proved.

During 1917, new collieries were laid down by the Taupiri Coal Mines, Limited, at Awaroa near Rotowaro Station, on the Huntly-Pukemiro Railway, also by the Mount Torlesse Collieries, Limited, near Avoca on the Christchurch-Arthur's Pass railway. In the Wairio district, Southlands, several new coal-mining leases were taken up to work portions of the extensive area of brown coal known to occur in that locality. Owing to the approaching exhaustion of the Point Elizabeth State mine, and the probable difficulty thereafter in supplying coal to meet the demand especially for railway and household requirements, an option was secured over an area of coal-bearing land in the Waikato district, and boring operations were conducted in order to prove the coal before a lease of the area was taken up for an extended period. A valuable extension of the Point Elizabeth coal beds, amounting to at least 200 acres, was proved to the north of Point Elizabeth colliery, thus extending the life of this State colliery. The coal seam varies in thickness up to 22 feet, and is probably identical with that mined at Point Elizabeth.

In 1918, there was a decrease of production of 34,169 tons, compared with the previous year, owing to a diminished output per person employed underground, and to an influenza epidemic, which caused most of the collieries to be idle for two or three weeks.

Considerable areas of workable coal were proved by Government drills near Awaroa, on the Waikato coalfield, and an area of 1,300 acres was taken up, on which a State mine for the North Island is to be established.

*The output from Point Elizabeth and Liverpool State collieries, during 1918, was 208,119 tons, of which 95,106 tons was produced from the former, and 113,013 tons from the latter. The

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* **New Zealand Official Year Book, 1919.**

State coal business during the year ended March 31, 1919, resulted in a profit of £30,607 as compared with a profit of £24,467 in the previous year.

[*]The Westport, Blackball and Northern Companies' activities include the carriage of coal by sea, by their own boats; in other cases, as at Kaitangata and Waipa, the companies provide railways for its transport to the most convenient point of loading on the State railway system.

At an inquiry by the Board of Trade in 1918, it was found that during the war period a considerable increase had taken place in the cost of carriage of coal by land and sea, especially in the latter case. While the railway freight increased on all routes, by 21 per cent., marine freight rose on the various routes by amounts bearing different ratios to the original charges. These amounts, together with the percentage rises, in regard to the west coast and Australian coal traffic of the four chief centres, are set out in the following table. Wherever steamers other than those of the Union Steamship Company were used, the freights were higher.

Ordinary shipping freight per ton of coal.

From	To	1914.		1918.		Increase.
		s.	*d.*	*s.*	*d.*	Per cent.
Westport and Greymouth	Wellington	5	7	9	7	72
„ „	Lyttelton	6	6	10	6	61
„ „	Dunedin	7	6	11	6	54
Newcastle	Auckland	10	3	16	3	59
„	Wellington and Lyttelton	10	6	16	6	57
„	Dunedin	12	6	18	6	48

The percentage increase in the total transport charges was, of course, less than in marine freight. In the trade from Newcastle wharf to Christchurch railway station, the increase was 44 per cent.; and the increase of the carriage between the Denniston mine, near Westport, and Christchurch railway station was 42 per cent.

The New Zealand coal mines are more or less remote from the chief consuming centres, and the cost of transportation, by rail or sea, is an important item in the cost of coal to the consumer. For example, in the case of Taupiri house coal, the cost of transport added 40 per cent. to the selling price f.o.r. at the mine (September 1918), and represented 23 per cent. of the net cost of coal to the consumer at Auckland.

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[*] Report of the Board of Trade on the (New Zealand) Coal Industry, May 20th, 1919. [H.—44A.]

Analyses of New Zealand Coals.[*]

Locality.	Fixed carbon.	Volatile Hydro-carbons.	Moisture.	Ash.	Sulphur.	Coke.	Calorific Value.	Evaporative Power
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cals.	Lb.
Buller Coalfield :—								
Wellington Co. (crushed)	76·90	16·20	0·80	6·10				
Ngakawau (crushed)	74·68	21·51	2·61	1·20				
Westport Co....	61·75	34·20	2·53	1·54				
Plateau	66·12	28·82	4·25	0·81				
Plateau	59·88	32·57	6·66	0·89				
Plateau	66·34	29·91	2·78	0·97				
Mokihinui	55·43	38·38	4·67	1·52				
Northern Collieries (Kiripaka Ngunguru) ...	43·08	44·79	4·65	7·48	1·03	50·56	6,581	7·37
Greymouth Coalfield :—								
Greymouth Coal Co.	53·03	41·95	0·99	3·98				
Brunner Coal Co.	53·50	41·28	1·41	3·81				
Coal Pit Heath Co.	59·38	35·48	1·05	4·09				
Paparoa Coal Co. (No. 1 Seam)	78·90	16·93	0·40	3·77	0·37	82·67	8,439	9·44
Paparoa (best)	62·90	33·53	0·67	2·90	0·33	65·80	8,443	9·45
Mine Creek, Millerton Colliery (best)	57·67	41·14	0·91	0·28	4·62	57·95	8,227	9·21
Coalbrookdale, Munsie's Section	55·73	40·08	2·37	1·82	0·55	57·55	7,923	8·87
State Coalmines, Point Elizabeth (best)	56·07	40·58	0·60	2·75	0·49	58·82	8,213	9·19
State Coalmines, Point Elizabeth (household) ...	48·70	41·52	8·36	1·42	0·82	50·12	7,143	8·00
Tyoeside Mine, Brunnerton	56·57	37·22	0·46	5·75	2·67	62·32	8,064	9·03
Blackball Mine (lower seam)	46·67	48·66	3·52	1·15	4·70	47·82	7,541	8·44
Puponga (west workings)	49·28	41·51	4·94	4·27	0·42	53·55	6,921	7·75
Hikurangi Coal Co.	44·56	47·17	4·06	4·21	5·81	48·77	6,810	7·63
Bay of Islands :—								
Kawa Kawa Mine	57·29	36·00	4·60	2·20				

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[*] Traus. Institute of Mining Engineers (London), Vol. II, page 324. Report of Board of Trade on Coal Industry, 1919. Coal Resources of the World, 1913, Vol. I, p. 77.

*Analyses of New Zealand Coals**—continued.

Locality.	Fixed carbon.	Volatile Hydro-carbons.	Moisture.	Ash.	Sulphur.	Coke.	Calorific Value.	Evaporative Power.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Cals.	Lb.
Kaitangata Coalfield (Otago Coalfield) :—								
Kaitangata Co.	46·84	40·52	9·20	3·24				
Kaitangata Co	44·18	38·22	15·41	2·19				
Kaitangata Co.	38·00	39·96	18·22	3·82	0·40		5,553	6·22
Nightcaps, Southland (new workings)	41·20	38·72	17·56	2·52	0·28		5,737	6·42
Shag Point Coalfield :—								
Shag Point Mine	43·15	33·70	14·40	1·00				
Whangarei Coalfield :—								
Whau Whau	47·91	40·70	8·19	3·20				
Kamo Mine	50·01	37·69	9·61	2·69				
Kamo Mine	50·58	36·52	9·25	3·65				
Malvern Hills Coalfield :—								
Springfield	59·90	26·60	9·40	4·10				
Springfield	47·80	27·80	18·20	6·20				
Homebush	41·80	29·60	26·20	2·40				
Wallsend	36·80	29·10	26·80	7·30				
Canterbury	46·02	26·99	21·66	5·33				
Stevenson	53·30	32·95	9·98	2·75				
Homebush, Canterbury	31·83	41·82	23·15	3·20	0·41		4,953	5·54
Waikato Coalfield :—								
Knpa Kupa Mine	47·45	29·11	15·00	2·45				
Taupiri	44·40	35·30	18·90	1·40				
Taupiri, Taupiri Extended	43·73	42·12	11·72	2·43	0·32		6,129	6·86
Green Island Coalfield :—								
Fern Hill Co....	35·70	39·80	23·10	1·40				
Green Island Co.	40·30	37·78	17·95	3·97				
Walton Park	41·23	36·97	18·07	3·49				
Saddle Hill	42·39	41·04	14·22	2·29				
Bannockburn, Central Otago	23·75	43·83	26·12	6·30	0·32		4,291	4·80
Mataura, Southland	19·01	40·77	35·65	4·57	8·31		3,789	4·24

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* Trans. Institute of Mining Engineers (London), Vol. II., p. 324. Report of Board of Trade on Coal Industry, 1919. Coal Resources of the World, 1913, Vol. I, p. 77.

*Analyses of New Zealand Coals.**

Composition of upper and lower Limits, calculated on the pure combustible (*i.e.*, moisture and ash free).

	Fixed carbon.	Volatile hydro-carbons.	Ash on dry coal.	Average moisture.
	Per cent.	Per cent.	Per cent.	Per cent.
Lignites (4)	47·5–40·0	60·0–52·5	7·7–5·3	28
Brown Coals (3) ...	46·3–43·5	56·5–53·7	7·7–3·9	26
Bituminous (12) ...	69·0–53·0	47·0–31·0	9·6–1·0	
Steam (4 typical) as shipped for Admiralty	89·0	11·0	10·0	
Anthracites (?)— "Mammoth" ...	78·7	21·3	15·0	
" ...	82·8	17·2	5·2	
Anthracite (Wairoa) ...	93·7	6·3	3·1	

* Fuel, by J. S. Brame (1919.)

Production of Coal in New Zealand.

—	Quantity (long tons).				
	Bituminous Coal.	Pitch Coal.	Brown Coal.	Lignite.	Total.
1913	1,160,274	2,397	624,852	100,482	1,888,005
1914	1,492,315	1,998	691,367	89,913	2,275,593
1915	1,267,940	136,460	725,001	79,223	2,208,624
1916	1,422,074	—	653,898	181,163	2,257,135
1917	1,247,989	—	629,174	191,256	2,068,419
1918	1,122,308	—	705,773	206,169	2,034,250
1919	961,107	—	684,331	202,410	1,847,848

NOTE.—Since 1915, the coal formerly classified as pitch coal has been included in bituminous coal.

Production of Coal in New Zealand.

Name of colliery.	Locality.	Class of coal.	Output for 1918 (long tons).	Output for 1919 (long tons).
Northern District—				
Hikurangi	Hikurangi...	Bituminous	65,361	77,845
Taupiri Extended	Huntly ...	Brown ...	203,015	172,561
Taupiri Rotowaro	Rotowaro ...		31,618	73,990
Pukemiro	Pukemiro ...		114,458	89,261
Waipa	Glen Massey		69,085	54,168
West Coast District—				
Coalbrookdale ...	Millerton ...	Bituminous	240,096	217.630
	Denniston...		179,630	147,766
Westport-Stockton ...	Mangatini...		154,120	129,125
State Coal Mines — Point Elizabeth	Dunollie ...		95,106	45,885
State Coal Mines — Liverpool ...	Rowanui ...		113,013	121,710
Blackball	Blackball ...		121,259	94,016
Paparoa	Roa ...		34,145	23,790
Southern District—				
Kaitangata and Castle Hill	Kaitangata	Brown ...	124,985	103.550
Nightcaps	Nightcaps...		53,805	48,282
Other New Zealand Collieries	All coalfields	Various ...	434,554	448,269
		TOTAL	2,034,250	1,847,848

Production of Coal from State Mines in New Zealand.

Fiscal years ending March 31.

Year.	Output (long tons).	Quantity for Disposal* (long tons).
1913	247,200	227,034
1914	198,279	177,816
1915	226,149	215,458†
1916	238,200	‡
1917	277,845	‡
1918	246,273	‡
1919	214,919	207,281
1920	156,228	149,203

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* After allowing for consumption and waste.

† Including stock from previous year.

‡ Not stated.

*Exports of Coal from New Zealand.**

To	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	141,540	140,010	183,916	115,682	102,970	90,890	85,299
Egypt...	—	—	29,621	25,246	206	2,506	—
Union of South Africa	—	—	200	—	—	—	—
Canada	1,760	2,530	3,350	5,330	5,532	4,959	5,947
India	—	—	—	—	—	400	—
Straits Settlements ...	—	902	1,793	49,811	2,700	—	—
Australia	33,185	53,703	35,874	51,972	32,073	27,112	26,496
British Oceania ...	18,183	14,191	16,060	18,962	17,625	8,523	8,990
Total to British Possessions	194,668	211,336	270,814	267,003	161,106	134,390	126,732
France	—	400	—	—	—	—	—
Germany	—	30	—	—	—	—	—
Italy	—	—	—	—	—	—	54
Panama	—	—	—	—	300	—	—
United States ...	3,200	10,256	5,072	17,999	15,643	18,177	12,486
Argentina	—	—	1,400	—	—	—	—
Chile	1,300	250	4,140	1,815	994	1,100	247
Uruguay	—	260	—	—	—	—	—
Guam...	—	75,333	32,817	40,705	46,087	29,372	3,125
Japan...	—	—	—	—	500	—	—
Foreign Pacific Possessions	12,581	9,835	9,749	4,153	4,213	2,468	7,649
Total to Foreign Countries	17,081	96,364	53,178	64,672	67,737	51,117	23,561
TOTAL ...	211,749	307,700	323,992	331,675	228,843	185,507	150,293
	Value (£).						
United Kingdom ...	143,413	149,239	194,506	121,734	117,414	122,854	137,341
Egypt...	—	—	31,355	26,307	226	3,569	—
Union of South Africa	—	—	210	—	—	—	—
Canada	1,760	2,599	3,350	5,198	5,532	8,266	10,703
India	—	—	—	—	—	400	—
Straits Settlements ...	—	654	1,299	41,688	3,839	—	—
Australia	28,159	44,414	33,652	48,509	33,563	31,886	32,595
British Oceania ...	16,615	11,605	13,501	17,983	17,395	11,949	13,102
Total to British Possessions	189,947	208,511	277,873	261,419	177,969	178,924	193,741
France	—	430	—	—	—	—	—
Germany	—	52	—	—	—	—	—
Italy	—	—	—	—	—	—	100
Panama	—	—	—	—	367	—	—
United States ...	2,972	10,404	4,963	19,614	16,106	18,177	17,361
Argentina	—	—	1,015	—	—	—	—
Chile	1,417	265	4,031	2,293	1,390	1,664	401
Uruguay	—	299	—	—	—	—	—
Guam...	—	58,759	33,079	41,172	43,092	28,853	3,302
Japan...	—	—	—	—	750	—	—
Foreign Pacific Possessions	10,674	8,183	8,770	4,298	4,282	3,420	12,663
Total to Foreign Countries	15,063	78,392	51,858	67,377	65,987	52,114	33,827
TOTAL ...	205,010	286,903	329,731	328,796	243,956	231,038	227,568

* 1916 includes 3,492 tons valued at £2,243 re-exported.
1917 includes 7,718 tons valued at £7,893 re-exported, and bunker coal.
1918 includes 2,904 tons re-exported and valued at £3,810, and bunker coal.
1919 includes 12,119 tons valued at £26,815, and bunker coal.

Imports of Coal into New Zealand.

From	Quantity (long tons).						
	1913.	1914.	1915.	1916.	1917.	1918.	1919.
United Kingdom ...	—	—	50	—	—	—	155
Union of South Africa	—	35,588	—	—	4,864	—	—
India	—	27,677	—	—	22,614	—	—
Australia	468,940	449,555	347,107	293,956	252,116	255,332	351,005
Fiji	—	—	6,314	—	—	—	—
Total from British Possessions	468,940	512,820	353,471	293,956	279,594	255,332	351,160
Portuguese East Africa	—	—	—	—	5,035	—	—
United States ...	—	—	—	—	—	—	40,272
Japan...	—	5,250	—	—	6,968	—	—
Society Islands ...	—	—	—	—	—	—	2
Total from Foreign Countries	—	5,250	—	—	12,003	—	40,274
TOTAL	468,940	518,070	353,471	293,956	291,597	255,332	391,434
	Value (£).						
United Kingdom ...	—	—	50	—	—	—	341
Union of South Africa	—	52,258	—	—	2,809	—	—
India	—	39,184	—	—	13,196	—	—
Australia	466,286	459,243	338,131	189,526	189,798	202,102	325,739
Fiji	—	—	6,314	—	—	—	—
Total from British Possessions	466,286	550,685	344,495	189,526	205,803	202,102	326,080
Portuguese East Africa	—	—	—	—	3,046	—	—
United States ...	—	4	—	—	—	—	55,931
Japan...	—	7,875	—	—	5,303	—	—
Society Islands ...	—	—	—	—	—	—	5
Total from Foreign Countries	—	7,879	—	—	8,349	—	55,936
TOTAL	466,286	558,564	344,495	189,526	214,152	202,102	382,016

Antarctica.*

The coalfields of the Ross Quadrant (or Australian sector) of Antarctica are of great extent, and probably stretch from the south pole to 73° S. latitude, a distance of over a thousand miles. Coal has been found at Mount Buckley, at the head of the Beardmore glacier, also at Mackay glacier, two localities 605 miles apart. It is estimated that coal-bearing rocks cover an area of 12,000 square miles. The concealed field to the west is also very large; six coal-seams, with an aggregate of 22 feet of coal, are reported. The age of the rocks containing the coal-seams is believed to be Permian.

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* Coal Resources of the World, 1913, Vol. I, p. 125.

An analysis of a sample of coal, apparently from the lowest seams, gave :—

	Per cent.
Moisture	3·16
Fixed carbon	68·84
Volatile matter	14·57
Ash	13·43
	100·00
Sulphur	0·274

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IMPERIAL MINERAL RESOURCES BUREAU.

The following is a list of the Official Publications (all prices are net, and those in parentheses include postage) :—

Reports on the Mineral Industry of the British Empire and Foreign Countries. (War Period, 1913-19.)

Aluminium and Bauxite ...	(1921)	Price	9*d.*	(10½*d.*)
Antimony	(1921)	,,	1*s.*	(1*s.* 1½*d.*)
Arsenic	(1920)	,,	6*d.*	(7*d.*)
Asbestos	(1921)	,,	1*s.*	(1*s.* 1½*d.*)
Barium Minerals	(1921)	,,	9*d.*	(10½*d.*)
Bismuth	(1920)	,,	6*d.*	(7*d.*)
Borates	(1920)	,,	9*d.*	(10½*d.*)
Coal, Coke and By-Products				
Part I	(1921)	,,	3*s.* 6*d.*	(3*s.* 8½*d.*)
Part II		,,	6*s.* 6*d.*	(7*s.*)
Part III		,,	*(in the press.)*	
Chrome Ore and Chromium	(1920)	,,	1*s.*	(1*s.* 1½*d.*)
Cobalt	(1921)	,,	9*d.*	(10½*d.*)
Copper	(1922)	,,	4*s.*	(4*s.* 2½*d.*)
Felspar	(1920)	,,	6*d.*	(7*d.*)
Fluorspar	(1921)	,,	9*d.*	(10½*d.*)
Fuller's Earth	(1920)	,,	6*d.*	(7*d.*)
Gold	(1922)	,,	6*s.*	(6*s.* 5*d.*)
Industrial Lead Poisoning		,,	5*s.*	(5*s.* 3½*d*)
Iron Ore Resources of the World.				
Parts I, II, III, IV and V ...		,,	*(in the press.)*	
Lead	(1922)	,,	3*s.*	(3*s.* 2*d.*)
Magnesite	(1920)	,,	1*s.* 3*d.*	(1*s.* 4½*d.*)
Manganese	(1921)	,,	3*s.* 6*d.*	(3*s.* 8½*d.*)
Mica	(1921)	,,	9*d.*	(10½*d.*)
Monazite	(1920)	,,	6*d.*	(7*d.*)
Nitrates	(1920)	,,	9*d.*	(10½*d.*)
Phosphates	(1921)	,,	2*s.*	(2*s.* 1½*d.*)
Platinum and Allied Metals	(1922)	,,	2*s.*	(2*s.* 1½*d.*)
Sulphur and Iron-Pyrites ...	(1922)	,,	1*s.* 6*d.*	(1*s.* 7½*d.*)
Talc	(1921)	,,	9*d.*	(10½*d.*)
Tin	(1922)	,,	3*s.*	(3*s.* 2*d.*)
Tungsten	(1921)	,,	1*s.*	(1*s.* 1½*d.*)
Zinc	(1921)	,,	3*s.* 6*d.*	(3*s.* 8*d.*)
Statistical Summary (Production, Imports and Exports)	(1913-20)	,,	3*s.*	(3*s.* 2*d.*)

The Mining Laws of the British Empire and of Foreign Countries.

Volume I, Nigeria	(1920)	Price	15*s.*	(15*s.* 6½*d.*)
Volume II, West Africa (The Gold Coast, Ashanti, The Northern Territories, and Sierra Leone)	(1920)	,,	15*s.*	(15*s.* 7*d.*)
Volume III, The Transvaal ...		,,	*(in the press.)*	
Volume IV, British Columbia ...		,,	£1 1*s.*	£1 1*s.* 6*d.*